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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

SUBCOMMITTEE ON RELIABILITY AND RISK ASSESSMENT

+ + + + +

MEETING

+ + + + +

FRIDAY

MARCH 27, 2009

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The Subcommittee convened in Room T2B3 in the Headquarters of the Nuclear Regulatory Commission, Two White Flint North, 11545 Rockville Pike, Rockville, Maryland, at 1:00 p.m., Dr George Apostolakis, Chair, presiding.

SUBCOMMITTEE MEMBERS PRESENT:

GEORGE APOSTOLAKIS, Chair

DENNIS C. BLEY

SAID ABDEL-KHALIK

WILLIAM J. SHACK

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NRC STAFF PRESENT:

HAROLD VANDERMOLEN, Designated Federal

Official

GARY DeMOSS

MARY DROUIN

CHRISTIANA LUI

GARETH PARRY

ALSO PRESENT:

KEN CANAVAN

DOUG TRUE

DON VANOVER

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A-G-E-N-D-A

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Presentation -- NUREG-1855, Appendix A.....	6
Mary Drouin, NRC	
Gareth Parry, NRC	
Ken Canavan, EPRI	
John Lehner, BNL	
Don Vanover, ERIN	
Doug True, ERIN	
Jeffrey LaChance, SNL	
Timothy Wheeler, SNL	
Adjourn	

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

12:59 p.m.

CHAIR APOSTOLAKIS: The meeting will now come to order. This is a meeting of the Advisory Committee on Reactor Safeguards Subcommittee on Reliability and Risk Assessment.

I am George Apostolakis, Chairman of the Subcommittee.

Subcommittee members in attendance are Said Abdel-Khalik, Dennis Bley, and William Shack.

The purpose of this meeting is to discuss example uses of the guidance and performance of sensitivity and uncertainty analysis as described draft NUREG-1855, guidance on the treatment of uncertainties associated with PRAs and risk informed decision making. And the latest version of the companion EPRI report, treatment of parameter and modern uncertainty for probable risk of risk assessments, dated April 2008.

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

Harold VanderMolen is the designated federal official for this meeting.

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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*
4 *Register* on March 13, 2009.

5 A transcript of the meeting is being kept
6 and will be made available as stated in the *Federal*
7 *Register* notice.

8 It is requested that the speakers first
9 identify themselves and speak with sufficient clarity
10 and volume so that they can be readily recorded.

11 We have not received any requests from
12 members of the public to make oral statements or
13 written comments.

14 We will now proceed with the meeting. And
15 I call upon Ms. Mary Drouin of the NRC staff to begin.

16 MS. DROUIN: Okay. Thank you, George.

17 We're delighted to be here today.

18 (Laughter.)

19 We are. We are.

20 CHAIR APOSTOLAKIS: That's a good start.

21 MS. DROUIN: At the table with me is
22 Gareth Parry from NRR, Ken Canavan from EPRI, Doug
23 True, and Don Vanover from ERIN Engineering.

24 I want to reiterate that this was a
25 collaborative effort between NRC and EPRI. And from a

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1 personal perspective a a a tremendous success in the
2 collaboration here. I look forward to future ones of
3 this kind.

4 We were here in front of the full
5 committee the 1st of February. Yes.

6 MR. SHACK: Time flies when you're having
7 fun, yes.

8 MS. DROUIN: Yes. And at that time --
9 this is the word document.

10 PARTICIPANT: Oh, it's a word document.

11 MS. DROUIN: A word document.

12 There were comments that were raised by
13 the Subcommittee in terms of the Appendix, to 1855.
14 And we agreed to come back to go through the Appendix,
15 in particular, and try to address, well address, not
16 try to, to address how we have dealt with the comments
17 that, in my perspective, what we heard from the full
18 committee. I hope that we've addressed them
19 appropriately and you'll be happy with our
20 addressment.

21 So the way we're going to do the
22 presentation is, I'm going to quickly, quickly,
23 quickly, quickly walk through, here's were the
24 comments that we heard. And then we're going to go
25 through and you'll see part of your package is the

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1 actual pages from the document. And highlighted in
2 yellow we're going to walk through exactly how we
3 addressed the comments.

4 So our goal is that, at the end of the
5 day, is that, you know, you're happy with what we've
6 done to the Appendix. Because our intent, you know,
7 when we get to the future work, as you know, we need
8 to make this publically available in preparation for
9 the workshop on May 5th and 6th.

10 So starting with that. There were three
11 sets of comments that we thought we heard.

12 The first set of comments was that in
13 looking at the Appendix it was felt that the results
14 were presented in such in a way that they could be
15 misinterpreted as as as being general conclusions.
16 And that someone using it for a particular application
17 could just take what was in the Appendix and use it
18 kind of, almost like a template. And say okay, now
19 this is acceptable for this application. And that was
20 not the intent.

21 So we have gone through the document. And
22 in numerous places added caveats to keep reminding the
23 user that that's not, this is just an illustration of
24 how you apply the guidance. And it's not meant to be
25 interpreted as a generic template. So we're going to

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1 walk you through all of those.

2 The next set was on the particular example
3 when it came to the seismic is that the feeling is
4 that the seismic dependencies were not described in a
5 clear enough manner so that the user would understand
6 that he needs to, both, identify and model them.

7 And in several places we've gone through
8 the report and expanded our discussion to try and
9 clarify that dependency. And once again, you know,
10 we're going to go through and show you where we had
11 particularly added discussion and, you know, what we
12 did.

13 The last comment was the concern with the,
14 with the apparent arbitrary use of sensitivity
15 analysis to evaluate model uncertainties. And this
16 was a particular area in the HRA. And again we've
17 added more discussion to try and clarify that.

18 Then the last thing that we've done, which
19 was on our own initiative, is that, in going through
20 we've thought there was some places where, you know,
21 could still warrant some clarification. And so we
22 have made four areas in particular we've added some
23 more.

24 And that is in regards to the definition
25 of application, clarifying the screening of lower

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1 power and shutdown contribution, an evaluation that a
2 fire LERF is needed, and the basis for consuming fire
3 PRA results are conservative.

4 So just a quick summary of the comments
5 that, how how we understood them. We're now going to
6 walk you through page by page. And that is why this
7 is in a Word file because I could not figure out a way
8 how to do this in a PowerPoint file. This is just all
9 the pages but we can skip right to this one which is
10 how I couldn't figure out how to do this in a
11 PowerPoint file. I can probably increase that. There
12 we go.

13 So, Gareth, do you want to --

14 MR. PARRY: Okay. I'll I'll stop at --
15 and Don will correct me if I say things wrong.

16 Basically, what we decided to do here is
17 that we decided to tighten up the definition of the
18 application to be specifically what's written here.
19 Because that's the way the calculation is done, in
20 fact.

21 And what we're saying is that the
22 technical specification change that we're proposing in
23 this one is to transfer something that is a routine
24 preventive maintenance that's currently performed at
25 shutdown and transform it into into the at-power.

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1 And you'll see some of the changes in the
2 document. I don't think we actually highlighted them,
3 but there's some other changes in the document that
4 make that clearer.

5 There is one change you will see later on
6 that explains that, basically, when we're dealing with
7 risk we're not going to, we're not going to credit the
8 decrease in risk from the shutdown that's associated
9 with this. Which would be the, a valid way of doing
10 it. And that's in the sense of a conservative
11 estimate in the change in risk. So you'll see that
12 we've added that as a as a caveat. So that's the
13 reason we made this change.

14 We if we go on now --

15 CHAIR APOSTOLAKIS: Let me understand this
16 one.

17 MR. PARRY: Okay.

18 CHAIR APOSTOLAKIS: This reduction
19 associated with moving this maintenance on
20 availability from shutdown will be conservatively
21 omitted.

22 MR. PARRY: The risk reduction for the
23 shutdown phase is going to be conservatively omitted.

24 MR. SHACK: Because now it's available.

25 MR. PARRY: Because now it's, it's it's

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1 not, it's not dealt with in in shutdown.

2 MR. BLEY: I don't think in the package
3 you gave us you don't have the next page. But in the
4 old page, A-2 --

5 MR. PARRY: Yes.

6 MR. BLEY: Under the scope --

7 MR. PARRY: Right.

8 MR. BLEY: -- you talked about shutdown
9 modes of operation not relevant. And it just struck
10 me that that was kind of bad phrasing. It doesn't add
11 any, the change adds no shutdown risk. And then you
12 go on to say, but you might need to consider the
13 shutdown risk is reduced because of this. Is that
14 still in there given you have this sentence up front?

15 PARTICIPANT: No.

16 MR. PARRY: Actually it is. We we can fix
17 that sentence.

18 MR. BLEY: Okay.

19 MR. PARRY: But there's another sentence
20 later on that explains that we're not going to factor
21 in the decrease in risk --

22 MR. BLEY: Okay.

23 MR. PARRY: -- from not doing it at
24 shutdown.

25 MS. DROUIN: I'm sorry, Dennis. What

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1 sentence are you reading?

2 MR. PARRY: It's on A.2.

3 MR. TRUE: A.3.1.

4 MR. PARRY: A.3.1. It's in the middle of
5 it.

6 MR. TRUE: The third line down. Or third
7 and second line.

8 MR. PARRY: Yes.

9 CHAIR APOSTOLAKIS: Why why did you decide
10 to do this?

11 MR. PARRY: Because that's a, that's, in
12 fact, what we've calculated. That is what this
13 particular --

14 CHAIR APOSTOLAKIS: No. No. I mean --

15 MR. BLEY: I think they're saying in in
16 practice as you might want to do that, but this
17 example does not do that.

18 MR. PARRY: Correct.

19 MR. BLEY: Yes.

20 CHAIR APOSTOLAKIS: Does not what? Does
21 not --

22 MR. TRUE: Account for the decrease in
23 risk --

24 PARTICIPANT: Account for the decrease in
25 risk.

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1 MR. TRUE: -- associated with reducing the
2 unavailability of RHR during shutdown. But we're
3 going to increase --

4 CHAIR APOSTOLAKIS: I don't understand
5 why?

6 MR. TRUE: Why what?

7 CHAIR APOSTOLAKIS: If it's a decrease,
8 it's a decrease.

9 MR. PARRY: Yes, but we'd we'd have to
10 have a low power shutdown model to calculate it.

11 CHAIR APOSTOLAKIS: Well that's the
12 reason.

13 MR. PARRY: Yes.

14 CHAIR APOSTOLAKIS: Okay.

15 MR. VANOVER: A simplification if you
16 will.

17 MR. PARRY: Yes. Okay. I'll let Don
18 carry on with the next one. All right, Don.

19 MR. VANOVER: On page A-4, Table A-3 was
20 the assessment of the relevant external hazard groups.

21 And we just added some footnotes, cautions to make
22 sure that they weren't interpreted as generically
23 applicable for this type of hazard group for all
24 plants. Added a couple of clarifying footnotes.

25 MS. DROUIN: Now this this is the approach

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1 we've taken throughout the document. So when you see
2 these words here, you will see this kind of footnote
3 showing up all the way through the Appendix. So I
4 don't know if we, you know, need to go through every
5 single one. But we can show you the places, you know,
6 we're prepared to show you the places where we've
7 added these footnotes. And it's kind of the similar
8 footnote everywhere.

9 MR. BLEY: Yes. I think this takes care
10 of one thing that was in our comment. Something that
11 I probably didn't state too well the last time. When
12 I read through that Table --

13 MR. PARRY: Table A-3?

14 MR. BLEY: Table A-2, 3. Oh, it's now A-
15 3.

16 PARTICIPANT: Yes, the numbers have
17 changed.

18 MR. BLEY: The numbers have changed, yes.
19 When I read through this Table there are a
20 number of these hazard groups which essentially say
21 the same thing. And they say, you know, it could
22 decrease reliability, but the frequency of the damage
23 from this kind of group is small compared to the other
24 things.

25 Now, the thing that I didn't say well

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1 before, but I'll try to say it better this time. And
2 it could be a footnote or maybe you don't even need to
3 consider it. But it just struck me, if this came to
4 staff, if the submittal came like this is, I think it
5 would generate RAIs on these, how can you be sure of
6 that? Because, you know, if you hadn't done some of
7 the internal events you might be able to argue the
8 same kind of way.

9 So somewhere behind this has to be
10 something that shows a basis for saying the frequency
11 is small compared to the other things. And it just
12 struck me that if I were using this as a guideline
13 even though we're saying it's -- I figure I could say
14 words like these to cover the case.

15 When really, if you want to include in
16 your document or you'll be forced to later come up
17 with a justification for the claims that the
18 frequencies of these hazard groups were small compared
19 to the things that were already concluded.

20 MR. PARRY: And I think your your question
21 is a good one. But I think the way this would
22 probably be handled is that the the analysis that
23 would be underlying this would be in some, it would be
24 archival documentation. It wouldn't be necessarily in
25 the submittal. So when RAI, if it came in, I think

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1 you could go back and refer to the archival
2 documentation that would support these statements.

3 MR. BLEY: That's kind of what I assumed
4 would happen. I was I was wondering if it would be
5 why as to one people, but that's probably what will
6 happen to them. Although, but they probably all know
7 that anyway.

8 MS. DROUIN: I mean, are you looking for
9 an additional count, an additional caveat of a
10 different kind here that you think would be helpful?

11 MR. BLEY: Yes. You know, I think the
12 last time when we were saying, well, there was nothing
13 to justify this stuff here. And and and part of that
14 was because we were worried it could be interpreted
15 more broadly.

16 MR. SHACK: The question is whether this
17 is a justification or a conclusion. I'm reading it as
18 a conclusion of an analysis.

19 MR. PARRY: But that's not documented
20 here.

21 MR. SHACK: Yes. Right.

22 MR. BLEY: And it's documented as a
23 conclusion, but, I guess, rather than saying, "I want
24 you to include something." I'm wondering I'm
25 wondering if a footnote saying, you know, "These kind

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1 of responses will almost surely generate request for
2 justification of these conclusions." It would be
3 worthwhile.

4 CHAIR APOSTOLAKIS: Are you talking about
5 the second one --

6 MR. BLEY: No. There's about six of them,
7 George, that have essentially the same --

8 MR. SHACK: Small compared to the internal
9 events.

10 MR. BLEY: Yes.

11 CHAIR APOSTOLAKIS: How about a footnote
12 along the lines that Gareth mentioned that during
13 similar analysis some place that justifies this
14 conclusion. I mean, there has to be something
15 somewhere.

16 MR. SHACK: Well maybe it's the heading
17 that says, "Basis". Maybe it will be better just to
18 change that to, "Conclusion".

19 MR. BLEY: Well even it were conclusion
20 you would want to --

21 MR. SHACK: Yes, but, basis makes it sound
22 as though that's the reason. Conclusion says that
23 that's a conclusion of something else.

24 MR. BLEY: That somewhere else is this
25 information.

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1 MR. SHACK: Right.

2 CHAIR APOSTOLAKIS: So you need two things
3 then. Change the heading to, "Conclusions". And then
4 have some footnote that says or justification go
5 somewhere else.

6 MR. PARRY: I think "basis" is the right
7 word here. For, in the sense that what we're doing is
8 applying screening criteria here. So it's the basis
9 for, it's it's the basis for which screening criteria
10 we're using. Right?

11 MR. VANOVER: Yes. I think it sounds like
12 we need a --

13 PARTICIPANT: Oh, yes.

14 MR. VANOVER: -- clarifying footnote on
15 the approach column. The specific items that were
16 screened based on threat induced. The likelihood of
17 threat induced challenge. We could probably
18 reference, you know, supporting information for this,
19 the basis for this conclusion can be found in the
20 archival --

21 PARTICIPANT: Yes.

22 MR. BLEY: I think something like that
23 would be useful. They have they have to have done
24 something more than just make a judgement here that
25 it's small.

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1 PARTICIPANT: Right.

2 MR. BLEY: I know for seismic there is a
3 lot more, but seismic didn't say these this little pat
4 phrase.

5 PARTICIPANT: No.

6 MS. DROUIN: So I just want to make sure
7 that we're real clear here. What we're proposing is
8 that right here on the approach column that we're
9 going to be adding another footnote. And this
10 footnote will say something to the fact that, you have
11 to go to your archival documentation in terms of the
12 justification of some the screening.

13 PARTICIPANT: Yes.

14 MR. BLEY: I guess I would put it under
15 "basis". As another footnote under basis.

16 CHAIR APOSTOLAKIS: Why do you have to
17 refer to it as a guide? I mean the PRA or the
18 baseline PRA. Whatever that is.

19 MR. SHACK: Well, Don had said IPEEE which
20 is probably where it really is.

21 PARTICIPANT: Yes.

22 CHAIR APOSTOLAKIS: The what?

23 MR. PARRY: It would be in IPEEE a lot of
24 it.

25 PARTICIPANT: Right.

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1 MR. BLEY: If you hadn't found it there
2 you might have it somewhere else. That seems
3 reasonable to me. We've got it. You want to see it.
4 Come and look.

5 MR. TRUE: I think other term we used
6 elsewhere is Tier 2. So we could just refer to it as
7 being contained in the Tier 2 documentation.

8 MR. CANAVAN: I might --

9 MR. BLEY: I missed that.

10 MR. TRUE: This is below the --

11 MR. CANAVAN: -- yes, I might --

12 PARTICIPANT: It mixes --

13 MR. CANAVAN: -- just limit it to
14 reference. Because in some cases plants located near
15 airports for example have it in there FSAR. So they
16 might actually be using a number in their FSAR.

17 MR. BLEY: It could be in a lot of places.

18 MR. CANAVAN: Yes. I'd just say,
19 "reference material or other reference material," or
20 leave it sort of as that. You might have calculated
21 it. You might --

22 MR. VANOVER: So I think the footnote is
23 applicable to the last four groups of approaches.

24 MR. PARRY: Right.

25 MR. VANOVER: But not the first two. So I

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1 wouldn't want to put it on the header to column.

2 MR. BLEY: Oh, okay. It looked to me like
3 it applied to aircraft impacts, extreme winds, turbine
4 generated missiles.

5 MR. VANOVER: Yes. Everything in that
6 group. Everything in that group on the approach
7 column. I think the last four groups in the approach
8 column.

9 CHAIR APOSTOLAKIS: The first, the first
10 row --

11 MR. TRUE: The ones that are extreme
12 because --

13 CHAIR APOSTOLAKIS: -- the first row
14 refers to a plant specific PRA.

15 MR. PARRY: Yes.

16 MR. TRUE: Yes.

17 PARTICIPANT: Yes.

18 CHAIR APOSTOLAKIS: Which is somewhere.

19 MR. PARRY: Yes. Not in the submittal.
20 It's in the documentation --

21 CHAIR APOSTOLAKIS: So shouldn't the
22 others then refer to that?

23 MR. PARRY: It might not be, well the
24 plant specific PRA is probably the PRA model as it
25 exists.

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1 CHAIR APOSTOLAKIS: Right.

2 MR. PARRY: This other stuff would
3 probably be in documentation that's more related to
4 IPEEE. And it would be in their screening analysis.

5 MR. BLEY: And in this example these were
6 things that weren't modeled explicitly in the PRA.

7 MR. PARRY: That's right. They would not
8 be in the PRA.

9 MR. SHACK: But it's just a footnote on
10 that screen from --

11 MR. PARRY: Okay.

12 MR. SHACK: -- consideration based on
13 likelihood. So you just put a footnote there. And --

14 MR. PARRY: Yes. Okay.

15 MR. SHACK: -- deal with it.

16 MR. VANOVER: Yes. And what I propose, we
17 put the same footnote to the last three --

18 MR. PARRY: Right.

19 MR. VANOVER: -- rows in the approach
20 column as well on the second page of that Table.

21 MR. PARRY: Yes. They would be the same
22 thing.

23 PARTICIPANT: Okay.

24 MR. PARRY: Yes.

25 MR. BLEY: Is this the whole Table now?

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1 It says it all?

2 MR. SHACK: A slightly different set of
3 documentation.

4 PARTICIPANT: Oh, okay. You're not seeing
5 the --

6 MR. BLEY: I'm looking at I'm looking at
7 the rest of it on the old --

8 PARTICIPANT: Okay.

9 MS. DROUIN: It has it has, if all goes to
10 the next page.

11 PARTICIPANT: Yes.

12 MR. VANOVER: Okay.

13 MS. DROUIN: So I I just, we're putting
14 the footnote not on the actual column heading --

15 PARTICIPANT: No.

16 MS. DROUIN: -- of approach, but we're
17 putting it on the rows on particular rows under the
18 approach column heading --

19 PARTICIPANT: Where it's applicable.

20 MS. DROUIN: -- where it's applicable.

21 PARTICIPANT: Yes.

22 PARTICIPANT: I think that's applicable.

23 CHAIR APOSTOLAKIS: Under the approach or
24 under the basis?

25 MS. DROUIN: No. Not under the basis.

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1 PARTICIPANT: Under the approach.

2 MS. DROUIN: Under the approach.

3 MR. TRUE: And we don't have to repeat it
4 on every single one of them. It applies across.

5 PARTICIPANT: Yes.

6 MS. DROUIN: Okay.

7 MR. VANOVER: Okay. Good. The next page
8 in the handout, A-6, is just further clarification of
9 the first issue that Gareth brought up about the --

10 CHAIR APOSTOLAKIS: Before you go to the -
11 -

12 MR. VANOVER: -- the power shutdown --

13 CHAIR APOSTOLAKIS: -- the page starts,
14 the out power PRA and what is used in this analysis
15 include; an internal events, an internal floods.
16 Model you mean? An internal events model?

17 MR. VANOVER: Yes. We can add that.

18 PARTICIPANT: Well, it says model up --

19 CHAIR APOSTOLAKIS: Yes. But include an
20 internal events.

21 MR. VANOVER: Oh, okay. The English is a
22 little awkward, you know.

23 CHAIR APOSTOLAKIS: But a little model
24 there.

25 MR. BLEY: If you just said the out power

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1 PRA includes --

2 MR. PARRY: Internal events and internal
3 floods, and fire.

4 CHAIR APOSTOLAKIS: And models for
5 internal events.

6 MR. BLEY: It's like a sentence here.
7 It's at the end.

8 PARTICIPANT: In bullet form you kind of
9 lose it.

10 PARTICIPANT: Yes, you do. It falls off.

11

12 MR. VANOVER: What do we want to say here?

13 MR. PARRY: Say internal events, and
14 internal floods, and fire. Internal fire.

15 MR. VANOVER: Okay. Good. Yes. The
16 highlighted, at the bottom paragraph just reiterates
17 again the same clarifier as the initial page that
18 we're ignoring the shutdown reduction and risk.

19 CHAIR APOSTOLAKIS: Again, the message
20 though, I mean, I had to ask you three times until you
21 told me the reason we're doing this is because we
22 don't want to deal with a shutdown PRA. I'm an
23 innocent reviewer of this. And I'm trying to do my
24 own thing. The analysis will conservatively omit.
25 The message that you're sending is that you're doing

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1 it because it's a conservative thing to do. And
2 that's not your motivation. The motivation is that
3 you don't have the PRA.

4 MR. VANOVER : Yes, but --

5 CHAIR APOSTOLAKIS: Can you rephrase this
6 to make it clear?

7 MR. SHACK: But if it wasn't conservative
8 you wouldn't let them do it.

9 CHAIR APOSTOLAKIS: That's true. That's
10 but if I'm a user of this I may get the wrong
11 impression. I may even have my lower power and
12 shutdown PRA but these guys are telling me that
13 conservatively I shouldn't --

14 MR. BLEY: You might even get somebody at
15 your shop who looks at one where they did look at the
16 shutdown PRAs. Oh, you shouldn't be doing that --

17 CHAIR APOSTOLAKIS: Yes you should be --

18 MR. BLEY: -- in the conservative way.

19 CHAIR APOSTOLAKIS: But --

20 MR. BLEY: This example, for convenience
21 this example doesn't --

22 CHAIR APOSTOLAKIS: Yes. But you're not
23 getting to the low power shutdown.

24 MR. BLEY: You can have --

25 CHAIR APOSTOLAKIS: -- low shutdown --

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1 MR. BLEY: -- you know --

2 CHAIR APOSTOLAKIS: -- shutdown PRA
3 evaluations. We chose to do this conservative
4 approximation or whatever.

5 MR. BLEY: That's an example. But it can
6 be looked at in practice.

7 CHAIR APOSTOLAKIS: Yes but still,
8 exactly. Exactly.

9 MS. DROUIN: I mean, I agree. I think if
10 we went in and put words like for the convenience of
11 this example we did this, that would also further
12 emphasize the fact that you can't come in and just
13 take this example and apply it blindly.

14 MR. BLEY: Exactly.

15 CHAIR APOSTOLAKIS: You may put the words
16 like, you know, in order not to have to deal with the
17 low power shutdown PRA. Something like that.

18 MR. VANOVER: Yes. And some think that
19 was a specific motivation. It was just that we had a
20 comment that, we could have reduced the risk and we
21 just said, "Well, we didn't do that."

22 PARTICIPANT: Yes.

23 MR. BLEY: Well, when we left last time we
24 kind of agreed with you. You didn't have time to redo
25 calculations or add new calcs. So this was a way to

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1 get around it. But I think a little clarity that it
2 was more convenient to the example would help.

3 MS. DROUIN: Right.

4 MR. PARRY: Okay. We can --

5 MS. DROUIN: I agree. Not a problem.

6 MR. BLEY: Which would to not
7 misinterpreting it on --

8 MS. DROUIN: Yes.

9 MR. VANOVER: Okay. Page A-9. We had an
10 internal comment to reiterate that we weren't
11 calculating LERF explicitly for internal fires because
12 it was not available. We had said that previously,
13 but when someone looked at the Table they missed that
14 connection. So we added that.

15 I guess that goes to A-11.

16 CHAIR APOSTOLAKIS: Let me understand
17 this. Note that only fire CDF available and as such a
18 qualitative evaluation will need to be provided for
19 fire LERF. What is a qualitative evaluation of a fire
20 LERF?

21 MR. PARRY: I think it's an assessment of
22 the sequences that come out of the fire and the
23 discussions that they do not contribute to LERF. I
24 think that's correct. I think --

25 PARTICIPANT: For the separation.

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1 CHAIR APOSTOLAKIS: Why is that
2 qualitative?

3 MR. PARRY: Because there's no particular
4 calculation on on on, there's no calculation for LERF.

5 PARTICIPANT: Are you just saying we don't
6 think these --

7 CHAIR APOSTOLAKIS: Is it here somewhere?

8 MR. BLEY: It's discussed in the text.
9 Right?

10 MR. PARRY: Yes. It's in the text.

11 MS. DROUIN: I mean, but the the page
12 before it comes in and says, "Additional note that
13 only fire CDF is available. And as such, a
14 qualitative evaluation will needed to be provided for
15 fire LERF." So that's just reiterating and reminding
16 them that.

17 MR. PARRY: But there's a discussion, I
18 think, of the of the contributors.

19 MR. VANOVER: Yes. I think when we get in
20 to the contributors there's a discussion somewhere
21 about the LERF not dominating the assessment because
22 of the type of exit sequences that were involved in
23 that --

24 CHAIR APOSTOLAKIS: Where is that?

25 MR. VANOVER: -- RHR. I'm looking for

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1 that.

2 MR. PARRY: It's way way down --

3 PARTICIPANT: It's way back.

4 MR. PARRY: It's way back. It's where we
5 start talking about the fires. So it's somewhere on
6 that page -- it starts on page A-26, I think.

7 MS. DROUIN: Yes. Internal fire scenarios
8 and contributors.

9 CHAIR APOSTOLAKIS: A-26?

10 MS. DROUIN: It may not be you're A-26.

11 CHAIR APOSTOLAKIS: We don't have -- mine
12 jumps from A-25.

13 MR. SHACK: You have to go back to the
14 original document.

15 MS. DROUIN: No. You have to go with the
16 one that we gave you.

17 MR. BLEY: Yes. On page A-26. The
18 original document.

19 PARTICIPANT: I don't see it.

20 MR. VANOVER: Not right there, but --

21 MR. PARRY: It's somewhere.

22 MR. BLEY: I don't even remember that, but
23 that doesn't mean it's not here.

24 PARTICIPANT: It's near the Table that
25 summarizes --

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1 MR. BLEY: Oh, that's on page A-8 of the
2 original document. "Officially note that only fire
3 CDF is available and as such a qualitative evaluation
4 will need to be --

5 MR. SHACK: Where is that qualitative
6 evaluation is what we're looking for?

7 MS. DROUIN: That's what I just read you,
8 Dennis.

9 MR. BLEY: I know.

10 MR. VANOVER: Mary, move move that page up
11 to the bottom of page, the Table A-5. The footnote on
12 Table A-5 that's in your handout. On page A-9. Right
13 right there. We didn't highlight that because that
14 was there before.

15 MS. DROUIN: Oh, yes. There it is.

16 CHAIR APOSTOLAKIS: So what does that say?

17 MR. VANOVER: It says that, it's a
18 qualitative assessment that says, we don't think LERF
19 matters for this particular application due to the
20 reasons stated.

21 MR. PARRY: Because they're all long term
22 decay heat removal sequences.

23 MR. SHACK: -- an early release.

24 MR. PARRY: Yes.

25 MR. BLEY: If it actually said that. I

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1 mean it, if it, in said in 705, that you can't make an
2 early release because it's long term cooling, that --

3 MR. SHACK: It might be helpful.

4 CHAIR APOSTOLAKIS: I think if you deleted
5 "as is indicative from internal from the internal
6 events results" it would be clearer.

7 MR. VANOVER: Okay. There it is.

8 CHAIR APOSTOLAKIS: Because then you're
9 really focusing on the long term containment giving
10 more function.

11 Due to the nature of this function --

12 MR. TRUE: I think what we're really
13 saying in this is, if you look at the delta CDF for
14 internal events and internal floods. That $1.26E-7$.
15 And internal fires at $7.85E-7$. Internal fires is
16 larger by a factor of 6 or so. If you look at the
17 delta LERF for internal events, it's 2.67 times 10 to
18 the minus 10. Far below the threshold. Even if and,
19 we believe that the characteristics of the internal
20 fire scenarios are about the same, we wouldn't expect
21 that the delta LERF for a fire will ever been close to
22 our threshold. Maybe seven, maybe six times the the
23 internal events, but we don't expect it to be --

24 CHAIR APOSTOLAKIS: If you deleted those
25 words would distort the meaning?

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1 PARTICIPANT: You mean the phrase?

2 MR. PARRY: Well, "as it is indicative
3 from the --

4 CHAIR APOSTOLAKIS: "It is a very limited
5 impact on LERF," period.

6 MR. PARRY: Yes. I think it might be
7 good.

8 MR. TRUE: Well, we we could do that. I
9 think it actually decreases the value of the statement
10 because the way we did it was, we looked at the
11 internal events and said, it's the same, the nature of
12 the scenarios are the same. Internal events was --

13 MR. BLEY: If you wrote the sentence, and
14 said out loud, and put it in here instead of that
15 short phrase, it would be a whole lot clearer.

16 CHAIR APOSTOLAKIS: What did you say,
17 Dennis?

18 MR. BLEY: That is up to him to remember.

19 PARTICIPANT: Get the transcript.

20 MR. BLEY: It's on the transcript.

21 MR. TRUE: Yes. When will that transcript
22 be ready?

23 (Laughter.)

24 MS. DROUIN: -- talked about the fact that
25 we got this factor on the internal.

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1 PARTICIPANT: Mm-hmm.

2 MS. DROUIN: And then to come in and
3 explain the fire, we don't have that same difference.

4 PARTICIPANT: Yes, I --

5 MS. DROUIN: This is, this, the way it's
6 written now requires the reader to make that leap by
7 looking at the numbers versus coming right out and
8 pointing to him and telling that you'll do this. And
9 he'll have to figure it out on his own by looking at
10 the numbers.

11 PARTICIPANT: Right.

12 MR. BLEY: And one little bitty nit, back
13 to Table A-4 and footnote 2. If instead of just
14 saying, "It will need to be provided." If you have
15 said, "See the footnote for Table A-5 for a
16 qualitative discussion."

17 MR. PARRY: Yes. I think that's --

18 MR. BLEY: You wouldn't get the questions
19 we just got.

20 MR. PARRY: -- yes. I --

21 MR. TRUE: And then we had to go back and
22 change --

23 MR. PARRY: Yes. Yes.

24 MR. SHACK: Or else put that footnote in
25 the text.

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1 PARTICIPANT: That sounds good.

2 MR. PARRY: Yes, we might --

3 MR. CANAVAN: That's sort of what I was
4 just thinking. Do the qualitative right there.

5 MR. TRUE: Well you need to see the
6 numbers in front of you, I think.

7 MR. CANAVAN: Well, I wasn't so much going
8 to the numbers as so much the first part of the bullet
9 which just says --

10 MR. TRUE: Oh, well, the nature of the --

11 MR. CANAVAN -- charged --

12 MR. TRUE: -- that's --

13 MR. CANAVAN: -- the function --

14 CHAIR APOSTOLAKIS: But what would you say
15 to somebody, this is outside your current subject,
16 that we keep screaming about uncertainties and all
17 that and we still make decisions based on numbers like
18 1.28 10 to the minus 7, 6.49 10 to the minus 8, what
19 kind of credibility does this decision have?

20 PARTICIPANT: I'm only --

21 CHAIR APOSTOLAKIS: Can we really trust
22 such 10 to the minus 10? Are we playing games here or
23 what?

24 MR. BLEY: Well, there's an uncertainty
25 coming up in a few pages. I mean, the uncertainty

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1 analysis is --

2 PARTICIPANT: Yes.

3 MR. BLEY: -- toward the end --

4 MS. DROUIN: Well my recommendation, and I
5 I agree with you. This is this is ridiculous. And we
6 should slap our hands that we created a Table that has
7 something like $3.86E-6$.

8 PARTICIPANT: I agree with that.

9 MS. DROUIN: And we need to go, and I
10 agree, clean that kind of stuff up.

11 MR. TRUE: I thought George's plan was
12 broader than that.

13 PARTICIPANT: Yes.

14 MR. TRUE: 3 times 10 to the minus 10 --

15 CHAIR APOSTOLAKIS: But this is a little
16 broader --

17 PARTICIPANT: Yes.

18 CHAIR APOSTOLAKIS: -- because I --

19 (Laughter.)

20 MR. PARRY: But I also think though that,
21 in defense of putting these, these are the numbers
22 that come out of the calcs.

23 MR. BLEY: Actually they had even more
24 decimal points on them.

25 (Laughter.)

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1 MR. PARRY: You know, if you wanted to
2 check back though, and if you want to do the
3 independent calculation, you can you can check. I
4 don't think that's, but yes, your plan is a little
5 different. Can you really believe 10 to the minus 10?
6 Well if --

7 CHAIR APOSTOLAKIS: Or six.

8 MR. PARRY: Well, hopefully we can believe
9 six. But I mean, if if --

10 CHAIR APOSTOLAKIS: Well --

11 MR. PARRY: -- if you calculate the delta
12 at 10 to the minus 7, then if what you're really
13 saying is that the likelihood of getting early release
14 from that is really extremely low. That's the context
15 in which you have to take that 10 to the minus 10.

16 PARTICIPANT: The --

17 MR. PARRY: Yes. You really don't believe
18 the number, but you do believe that the value is
19 extremely low.

20 MR. CANAVAN: But maybe you start with
21 low, then if there's there's small and there's very
22 small, and then there's very, very small, and then
23 there's not worth talking about which is the numbers
24 that we're looking at now.

25 MR. BLEY: But let's got in to this

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1 argument about particular numbers. Way back in WASH-
2 1400 and the testimony before the Congress, they dealt
3 with it, was the only way I know to deal with it. And
4 say, you're supposed to model, you believe. It's
5 composed of pieces whose numbers you believe. And
6 just because they get been multiplied together doesn't
7 mean they're completely meaningless anymore.

8 PARTICIPANT: Right.

9 MR. BLEY: There might be something else
10 you've left out of course.

11 PARTICIPANT: Right.

12 MS. DROUIN: Right.

13 MR. BLEY: But for that thing you modeled

14 --

15 MR. PARRY: And we discussed that.

16 PARTICIPANT: It's there.

17 MR. CANAVAN: Good question.

18 MR. VANOVER: We can certainly reduce the
19 number of significant digits.

20 CHAIR APOSTOLAKIS: The expression --

21 MS. DROUIN: Yes. I mean, I just always
22 think that when you do that, it's implying a precision
23 that we ourselves don't believe.

24 MR. TRUE: So we'll just drop the third
25 significant digit?

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1 MS. DROUIN: I would.

2 MR. BLEY: I mean, there's argument -- and
3 then the pieces don't add up. If you got the other
4 Table --

5 MS. DROUIN: I --

6 MR. BLEY: -- with the percentages --

7 PARTICIPANT: Right.

8 MR. TRUE: Because some places say the
9 delta --

10 PARTICIPANT: You got to put --

11 PARTICIPANT: Then you are going to write,
12 how come they don't add up?

13 PARTICIPANT: I read a comment like that.
14 These numbers don't add to a hundred percent.

15 PARTICIPANT: Right.

16 MS. DROUIN: Okay.

17 MR. CANAVAN: You got to put plus or
18 minus.

19 MR. VANOVER: Okay. On the top of page A-
20 11. Mary, the next, I think you went too far.

21 CHAIR APOSTOLAKIS: Let me ask something
22 else. Is this work going to continue or this is it?

23 PARTICIPANT: It's --

24 CHAIR APOSTOLAKIS: The issue of
25 uncertainty, and sensitivity, and all that. After the

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1 Appendix with the NUREG got published. Finito?

2 MS. DROUIN: No. As as we said at the
3 full committee, we have plans to continue this work on
4 this NUREG. Exactly what we're going to do next year
5 is what we're going to have to, there's more than we
6 can do next year. So we're going to have to start
7 prioritizing what is it we're going to try and do in
8 the short term versus the long term. And our plan is
9 to use a lot of the insights to, from the workshop to
10 help us decide in our our our program offices what
11 should we be going after next.

12 CHAIR APOSTOLAKIS: And you're, at some
13 point in the future, you're also going to get in to
14 physical models with uncertainties like thermal
15 hydraulic codes and all that. Because this is really
16 PRA level 1 essentially.

17 MS. DROUIN: Right.

18 PARTICIPANT: Yes.

19 MS. DROUIN: Right.

20 CHAIR APOSTOLAKIS: So this is not the
21 final word.

22 MS. DROUIN: Absolutely not.

23 MR. CANAVAN: I think the particular part
24 that you're talking about, at least from EPRI's
25 perspective, that's a, probably a little further out

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1 than what our next steps are which are for other
2 hazard groups, other, maybe other levels of PRA. But
3 also in tandem looking at other types of uncertainty
4 like the codes uncertainty.

5 CHAIR APOSTOLAKIS: But if you get in to
6 fire analysis scan --

7 PARTICIPANT: Oh yes --

8 CHAIR APOSTOLAKIS: You have codes.

9 MR. CANAVAN: Sure. Sure.

10 CHAIR APOSTOLAKIS: You don't necessarily,
11 when I say thermal hydraulic, I don't mean real
12 applied.

13 PARTICIPANT: Right.

14 CHAIR APOSTOLAKIS: But any code that
15 models physical phenomenon you have uncertainties. I
16 think you need some guidance. So that's something
17 that will happen.

18 MS. DROUIN: Yes.

19 CHAIR APOSTOLAKIS: Okay.

20 MS. DROUIN: But I I, what I'm trying to
21 say is, I don't know when it will happen.

22 CHAIR APOSTOLAKIS: Yes.

23 MS. DROUIN: But, you know, we have plans
24 to try and address, you know, level two stuff, level
25 three. Expand this past just internal events and

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1 internal fire. Expand this to not just support
2 operating reactors, but new reactors.

3 But we're going to have to try and stand
4 back and say, you know, what should be the priority of
5 how we take these things on?

6 CHAIR APOSTOLAKIS: So you're going to
7 meet with us when you decided those things?

8 MS. DROUIN: Absolutely not. We always
9 come and we always value you your input.

10 CHAIR APOSTOLAKIS: And we appreciate your
11 cooperation.

12 MS. DROUIN: Thank you.

13 CHAIR APOSTOLAKIS: Did you take all that
14 down?

15 PARTICIPANT: That's the second time you
16 got him to laugh.

17 CHAIR APOSTOLAKIS: What?

18 PARTICIPANT: That's the second time she's
19 got you to laugh this afternoon.

20 PARTICIPANT: Is this a bet? I mean --

21 (Laughter.)

22 MS. DROUIN: Okay. Let's see, where are
23 we? We're on page A-11.

24 MR. VANOVER: Yes. Top of A-11. We added
25 a clarification of why we're doing a bounding seismic

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1 risk assessment since we don't have a full seismic PRA
2 to utilize for this site. And then, added a footnote
3 clarification that, to make sure this wasn't construed
4 as generic, a way to generically disposition seismic
5 contributors.

6 MS. DROUIN: Right. And this was also
7 getting in to clarifying your concern with regard to
8 the dependencies.

9 PARTICIPANT: Right.

10 MR. VANOVER: Yes. It gets a couple of
11 the specific examples with the dependencies.

12 MR. PARRY: But the first sentence here
13 too is that, I think it wasn't obvious from the tree
14 of the way it was written, that loss of offsite power
15 was assumed as a condition. I know John Stetkar was
16 worried about that.

17 MR. VANOVER: Right. So then when we get
18 in to the details of the discussion of the bounding
19 seismic assessment, we added some clarification to the
20 LOOP section on the top of page A-14.

21 CHAIR APOSTOLAKIS: So so far we've been
22 addressing the the question of generalizability of the
23 results. Right? You're making sure by excepting the
24 yellow stuff, that this case study what it, what we're
25 doing is meaningful. But don't generalize.

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1 MS. DROUIN: Right.

2 MR. VANOVER: Right.

3 CHAIR APOSTOLAKIS: That's really what
4 we've been doing so far.

5 MS. DROUIN: Except for here now.

6 MR. PARRY: Except for here.

7 CHAIR APOSTOLAKIS: Okay. So we start
8 something else now. Okay.

9 MS. DROUIN: Right. We're going to be
10 coming back and forth because, instead of trying to do
11 all the ones, for example, that dealt with
12 generalization, we're going through page by page and
13 showing you where, which ones. And and this
14 particular one gets in to both. It's the
15 applicability, the generalization. But also now
16 you're starting to see now what we've done to clarify
17 your concern on the dependencies.

18 CHAIR APOSTOLAKIS: So where are we?

19 MR. VANOVER: So we're at the top of page
20 A-14 --

21 PARTICIPANT: Yes.

22 MR. VANOVER: -- in the discussion of loss
23 of offsite power events for the seismic assessment.
24 So we hadn't really addressed the issue of
25 dependencies and seismic capabilities of components.

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1 So we tried to add that, what we're doing
2 here works, given the situation where the other
3 alternate containment heat removal mechanism, the vent
4 capability is higher than the RHR loops themselves. So
5 we added that clarification to provide further
6 justification that the bounding, that it was truly a
7 bounding calculation.

8 CHAIR APOSTOLAKIS: Again, you're
9 referring now to other studies somewhere else.

10 MR. TRUE: Yes.

11 MR. PARRY: Yes.

12 MR. TRUE: This would be the --

13 MR. PARRY: The seismic margin study.

14 MR. TRUE: Right.

15 CHAIR APOSTOLAKIS: So that exists
16 somewhere else.

17 MR. PARRY: That exists somewhere else.

18 CHAIR APOSTOLAKIS: Okay.

19 MS. DROUIN: So on this same page as you
20 see at the bottom --

21 CHAIR APOSTOLAKIS: Yes.

22 MS. DROUIN: -- are those typical footnote
23 for the clarification on the generalization.

24 CHAIR APOSTOLAKIS: I think you're
25 overdoing it with the footnotes, by the way. You

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1 could have combined them and say, that the originals
2 are going through the relevance of seismic induced
3 transient events and seismic induced LOOP events. I
4 mean, you really would cover --

5 MS. DROUIN: We were trying to make you
6 guys happy.

7 CHAIR APOSTOLAKIS: Happiness is oozing
8 out of my ears here. But --

9 MR. PARRY: Well obviously weren't not
10 happy enough with the, you know, the government health
11 warnings that we put on the front which said basically
12 the same thing. Because I think you raised the
13 question last time. So we thought, it's to remind
14 people.

15 CHAIR APOSTOLAKIS: It seems to me this is
16 childish. I mean the conclusion, it's exactly the
17 same. Seismic induced transient. Seismic induced
18 LOOP events. That's the only difference. One could
19 combine the two. If you don't want to do that, that's
20 fine.

21 MS. DROUIN: You know, I don't have a
22 problem with providing a -- it so happened because
23 they ended up --

24 CHAIR APOSTOLAKIS: You mean to tell me a
25 footnotes --

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1 MS. DROUIN: -- they ended up on the same
2 page.

3 PARTICIPANT: we can combine this.

4 MS. DROUIN: I mean, we weren't trying to
5 go overboard. But we really were trying to be --

6 CHAIR APOSTOLAKIS: I know you are. I
7 know you are.

8 MS. DROUIN: -- responsive to John
9 Stetkar's comment that he wanted to see, in his words,
10 "Lots of caveats". So we've given you lots of
11 caveats.

12 MR. PARRY: We'll combine them. And make
13 the --

14 MS. DROUIN: But --

15 MR. VANOVER: I mean, they're not, they
16 showed up on the same page, but they're three quarters
17 of a page apart.

18 PARTICIPANT: I know --

19 MR. VANOVER: If we go to tack that they
20 may not send us, show up on the same page.

21 MR. PARRY: Oh, that's a good point.

22 MS. DROUIN: So I will take your comment.

23 CHAIR APOSTOLAKIS: If you don't want to
24 do it, don't do it.

25 MS. DROUIN: No. I would like to do it.

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1 I just don't want to come back later and be criticized
2 that we don't have enough again.

3 CHAIR APOSTOLAKIS: This is, this comment
4 is made from the point of view of English only. So
5 if, you know, if, by saying seismic inducted transient
6 events and LOOP events, than the rest is the same.

7 MR. CANAVAN: Just use the same number
8 twice.

9 CHAIR APOSTOLAKIS: Let's not make a big
10 deal of it.

11 MS. DROUIN: Yes. Okay.

12 CHAIR APOSTOLAKIS: It's up to you.
13 Eventually, will be a letter of this. What are you
14 guys asking?

15 MS. DROUIN: No. You all sent a letter.
16 We have your letter.

17 CHAIR APOSTOLAKIS: But we don't like A.
18 I thought you --

19 MR. CANAVAN: You love it now.

20 CHAIR APOSTOLAKIS: What?

21 MR. CANAVAN: You love it now.

22 CHAIR APOSTOLAKIS: Well --

23 MR. SHACK: We can always write to letter
24 them.

25 CHAIR APOSTOLAKIS: It's not that I want

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1 to write a letter. I'm just asking the staff.

2 MR. BLEY: Well, I want to say that, now
3 that we've looked at the revision we're --

4 MS. DROUIN: Okay. I can just tell you,
5 my understanding, when we were at the full committee,
6 what the understanding was, is that, we would come
7 back to the subcommittee and go over these concerns
8 that you had to see if you were happy with those
9 concerns --

10 CHAIR APOSTOLAKIS: Right.

11 MS. DROUIN: -- with how we've addressed
12 them. And we were then going to make this appendix
13 publically available for the workshop. We were going
14 to take lessons learned from the workshop to see if we
15 needed to still refine the example. And then we were
16 going to publication. So we were not coming back to
17 you again for a letter on publication for this
18 appendix.

19 MR. BLEY: If I remember our
20 recommendation, we said, "Revise this before you
21 publish it."

22 MS. DROUIN: That's right. And that's the
23 next point.

24 MR. BLEY: I think that's the way we
25 stated it.

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1 MS. DROUIN: Your letter, you know, said -
2 -

3 CHAIR APOSTOLAKIS: If if the changes that
4 you make after the workshop are substantive, will we
5 see it again? I mean, we can not approve something
6 that is subject to change. Somehow we have to be
7 informed of what happened. Maybe a briefing to the
8 full committee that, as a result of the workshop this
9 is what we did. They are not a big deal. Blah blah
10 blah. So the letter stands.

11 MS. DROUIN: Yes. I I I would agree,
12 George, that if the comments or what comes out of the
13 workshop is, you got to go back to the drawing board.
14 But I'll be honest, I just don't see this happening.

15 PARTICIPANT: No.

16 MS. DROUIN: I don't see that the comments
17 coming back from the workshop are going to be
18 substantive.

19 CHAIR APOSTOLAKIS: Would it help you to
20 brief the full committee maybe for an hour? As a--

21 MS. LUI: I mean, if you're interested we
22 can definitely come back and brief you. And
23 meanwhile, we understand that you also have workload.
24 You have lots of letters to write. So I guess, you
25 know, it comes down to, at this point in time, we

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1 don't anticipate on going to have significant comments
2 coming up on the workshop that would put us on a
3 different path. Meanwhile we would be happy to come
4 back and give you information briefing.

5 And in the event that there are
6 significant comments that we are going to go on
7 different path and if you want to weigh in again, you
8 will certainly have that opportunity.

9 CHAIR APOSTOLAKIS: It's not that I want
10 to weigh in again. It's just that --

11 MR. BLEY: It strikes me that it would be
12 useful to us to hear how the workshop --

13 CHAIR APOSTOLAKIS: Yes. Exactly.

14 MR. BLEY: -- but --

15 CHAIR APOSTOLAKIS: In general --

16 MS. DROUIN: And that's what I was going
17 to, what our intent was. Maybe coming back later on
18 in the July time frame or later on where we can come
19 back and say, "Okay. Here is what we learned from the
20 workshop. Here's here's our initial ideas of what we
21 want to do in the future in terms --

22 CHAIR APOSTOLAKIS: Yes.

23 MS. DROUIN: -- of the next version of
24 this document." Not in terms of the little things
25 we've cleaned up on the example. But, you know,

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1 "Here's the plan we're laying out now on this work.
2 And we're looking to do this in the next six months.
3 This in the next year." You know, to give us time on
4 the staff part to digest what came out of the
5 workshop. And us laying out, you know, a path forward
6 --

7 CHAIR APOSTOLAKIS: Yes. That's all I'm
8 asking for.

9 MS. DROUIN: -- of what we might do next.
10 And that we had intended, yes, to come back.

11 CHAIR APOSTOLAKIS: It doesn't have to be
12 a briefing just on the workshop. I mean, if you
13 wanted to talk about your future plans, that's fine
14 too. But, if you could brief us as to what happened
15 at the workshop. Were people ecstatic? Or were there
16 a lot of objections? Or what?

17 MS. DROUIN: Well I'm hoping that members
18 of the ACRS will come to the workshop.

19 CHAIR APOSTOLAKIS: Well --

20 MS. DROUIN: Seriously.

21 CHAIR APOSTOLAKIS: When is it?

22 MS. DROUIN: May 5th and 6th.

23 CHAIR APOSTOLAKIS: I'm out.

24 MR. BLEY: That's when we're having
25 bunches of meetings. That's our only problem.

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1 CHAIR APOSTOLAKIS: There's a workshop in
2 Brookhaven those days.

3 MR. BLEY: There is a workshop at
4 Brookhaven. There is four, I think, subcommittee
5 meetings, those two days. So it's going to be --

6 CHAIR APOSTOLAKIS: How about, next time you
7 come here to talk about whatever you want to talk
8 about, spend ten minutes telling us what happened at
9 the workshop?

10 MS. DROUIN: Absolutely.

11 CHAIR APOSTOLAKIS: So you don't have to
12 spend much time preparing for it and we don't have to
13 have a special subcommittee for that. There is no
14 reason.

15 MS. DROUIN: All right.

16 CHAIR APOSTOLAKIS: That's all.

17 MS. DROUIN: Okay.

18 CHAIR APOSTOLAKIS: It takes us ten
19 minutes to finally agree. But --

20 MR. BLEY: From what we've heard you would
21 expect people to be coming to the workshop to learn
22 how to use this approach or that's the main --

23 MS. DROUIN: That's that's the main
24 purpose of the workshop.

25 And we were talking about it over lunch

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1 today. And based on Ken's knowledge, etcetera, we're
2 we're anticipating a good 75 people showing up at this
3 workshop.

4 CHAIR APOSTOLAKIS: These would be all
5 utility people. Right?

6 MR. CANAVAN: Mostly. Yes.

7 MR. PARRY: Well, we'll have some NRC
8 people too.

9 MS. DROUIN: We're hoping to get good NRC
10 attendance. Because this document is not just a
11 document for industry. It's a document also for, you
12 know, I mean, for the NRC of how to use this in our
13 decision making.

14 MR. CANAVAN: And there will be some
15 vendors and consultants.

16 We have 35, I think, early registers.
17 That's a lot.

18 CHAIR APOSTOLAKIS: Where will it be?

19 MR. CANAVAN: In the auditorium here.

20 MS. DROUIN: In the auditorium.

21 MR. SHACK: You have 35 what?

22 MR. CANAVAN: 35 early registrants.

23 MR. SHACK: Oh.

24 MS. DROUIN: And that doesn't include the
25 NRC people.

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1 MR. CANAVAN: And utility people are
2 notoriously late at signing up.

3 MS. DROUIN: And we'll be sending out a
4 second notice week after next.

5 CHAIR APOSTOLAKIS: Very good.

6 MR. TRUE: George, we have six people
7 coming from our company. Just so that we make sure
8 that everyone understands the document and the
9 ramifications. Because we think this will be
10 important as we go forward. And --

11 CHAIR APOSTOLAKIS: So a year from now
12 everybody will talking in terms of model uncertainty,
13 incompleteness uncertainty and everything. Right? We
14 will not be --

15 MR. VANOVER: Nope.

16 CHAIR APOSTOLAKIS: Given the fact though
17 that these were very nicely described in the original
18 regulatory guide 1174, I'm not holding my hopes very
19 high. But progress has been made.

20 MR. PARRY: Well, I think there wasn't
21 really that much guide, I mean are people confused
22 over what to do about it.

23 CHAIR APOSTOLAKIS: Yes.

24 MR. PARRY: I think this document should
25 really help them.

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1 PARTICIPANT: Confused about --

2 CHAIR APOSTOLAKIS: Well we're going to
3 account for some model uncertainty somewhere here.
4 Since it --

5 MS. DROUIN: Okay.

6 MR. VANOVER: Okay. Top of page A-15.
7 It's another example of the, addressing the issue
8 related to the dependencies and the seismic bounding
9 assessment. Based on re-looking at that calculation
10 and considering the assessment. We actually redid the
11 calculation from what it was before. And made sure
12 all the LOOP boundary conditions were appropriately
13 applied. And basically rewrote that whole section
14 there to discuss the new bounding analysis to address
15 the dependencies and so forth.

16 MS. DROUIN: Let me ask you something,
17 George. Going back to your comment about, we've gone,
18 maybe did an overkill with our footnotes. And what we
19 tried to do is that, as you see here we had a footnote
20 associated with LOCA events, a footnote associated
21 with reactor pressure vessel rupture one with LOOP and
22 the one before with the transient events. So, you
23 know, we were doing it every step. If I understand
24 you correctly, you would be perfectly happy if we
25 removed all of those and put one footnote, for

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1 example, on this whole section under conclusions
2 versus one under each --

3 MR. BLEY: A little suggestion. You may
4 not like it. What if there were a header that just
5 said, across each page, "Plant specific AOT example."

6 MS. DROUIN: That was just an example.
7 That to me wasn't what the concern was.

8 PARTICIPANT: No.

9 CHAIR APOSTOLAKIS: No. My comment
10 specifically referred to footnotes 4 and 5.

11 MR. BLEY: Because there were two on the
12 same page.

13 MR. TRUE: They were.

14 CHAIR APOSTOLAKIS: These two are
15 identical except for "transient events and LOOP
16 events."

17 MR. PARRY: Okay.

18 MS. DROUIN: Okay.

19 CHAIR APOSTOLAKIS: Seems to me, those two
20 can be combined.

21 MS. DROUIN: Right. But my point is, is
22 that, when you go to footnotes 6 and 7 they're almost
23 the same, but now instead of having seismic induced
24 transient events for 4. 5 would have seismic induced
25 LOOP events. We're now seismic induced LOCA events.

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1 And then number 7, which is kind of the catch all of
2 all of those.

3 MR. CANAVAN: We can look --

4 MS. DROUIN: I'm not trying to beat this
5 to death. But it's --

6 MR. PARRY: It doesn't hurt --

7 CHAIR APOSTOLAKIS: 6 and 7 are going to
8 be separate. I mean --

9 MR. PARRY: -- it doesn't do any harm to
10 have them separate.

11 CHAIR APOSTOLAKIS: The other two w I
12 thought was --

13 MR. TRUE: I'll cop to this because it
14 wasn't Mary's fault that it's all in there. I was the
15 one who went through it. What I did was, everywhere
16 that I thought we were drawing a conclusion, I tried
17 to put a footnote to say, "This conclusion is specific
18 to this thing." We came up some with some sort of
19 generic way of phrasing that which is quite
20 repetitive. We admit to that. But -- so that was the
21 philosophy that went in to this. We could roll it
22 back up to a higher level and in certain sections say,
23 "We're drawing these general conclusions. They should
24 not be construed as generic for other applications."
25 But you can do it either way. I think the footnote

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1 way keeps the flow of the text there and keeps you
2 from being disrupted by all these caveats in the text.

3 So that's why we went the footnote path.

4 MR. BLEY: Nobody can say they didn't see
5 it.

6 (Laughter.)

7 MR. TRUE: A further note, this was an
8 example.

9 MR. CANAVAN: Yes. I will note, we can
10 also flip it. We can say, start with the bottom and
11 say, "This example should not be construed as generic.

12 This is the position of this contributor including
13 seismic induced LOCA events are applicable specific."

14 So you can make one footnote with two things in it.
15 Reference it twice, same number, but one footnote that
16 applies multiple spots. That's a way of collapsing
17 them and still -- that's what a tech editor would do.

18 So, collapsing them and --

19 MS. DROUIN: I wasn't trying to beat this
20 to death. But it may be -- but I thought it was a
21 good comment because it's kind of irritating to see
22 that footnote 20 million times. But --

23 CHAIR APOSTOLAKIS: But if your people at
24 the workshop complain we can go to the ACRS.

25 (Laughter.)

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1 MS. DROUIN: Well that that that may be in
2 and it of itself why we may leave it in there.

3 MR. BLEY: We have tried putting a
4 watermark across tables and figures so people wouldn't
5 disconnect them from the text and they still do. So.

6 MS. DROUIN: Oh, I know. And the --

7 PARTICIPANT: Sure. However you do it --

8 CHAIR APOSTOLAKIS: It's okay.

9 MS. DROUIN: Okay.

10 CHAIR APOSTOLAKIS: So we're expecting now
11 to absorb this yellow long paragraph right now.
12 Right? Can you explain what it says?

13 MR. VANOVER: Sure. We looked at the
14 delta --

15 CHAIR APOSTOLAKIS: This is on page A-15.
16 Right?

17 MR. BLEY: It's almost the same paragraph
18 as before.

19 PARTICIPANT: The numbers are a little --

20 MR. TRUE: Well, the numbers are --

21 PARTICIPANT: Yes.

22 MR. TRUE: -- I'll jump in if you want.

23 MR. PARRY: Go ahead.

24 MR. TRUE: And we changed the, quite a bit
25 I think in the first, you know, paragraph.

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1 PARTICIPANT: Yes.

2 MR. TRUE: So the basic idea was to say,
3 "The worse this could be is that everything else
4 failed seismically and RHR never failed seismically,
5 and you look just at the differential reliability of
6 that remaining available RHR system. And as it, as
7 the maximum delta risk you could calculate." So
8 basically the calculation we did we, said, everything
9 else was failing. And we looked at what the seismic
10 LOCA risk with both trains and loops of RHR available
11 and with only one loop of RHR available. And we
12 calculated that delta. And we calculated that it was
13 only .3 percent of the acceptance criteria, and
14 therefore small. We felt like it was a definitely a
15 bounding characterization.

16 MR. PARRY: And particularly, if you think
17 about when you have seismic failures, if there were
18 any seismic failures, typically they'd fail the whole
19 system. And that's the way we modeled it. So it
20 really cancels out. The unavailability doesn't even
21 doesn't even show up.

22 MR. TRUE: The piece which we didn't
23 account for which was seismic failures of RHR --

24 MR. PARRY: Doesn't show up.

25 MR. TRUE: -- because of the correlation

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1 effect and the and the risk, seismic risk calculation
2 would only make that delta go down actually.

3 MR. CANAVAN: Yes. It would only decrease
4 the .3 percent.

5 CHAIR APOSTOLAKIS: Just a minor comment.
6 On the second yellow. From Table A-9 it can be seen
7 that the frequency of seismic can induce small,
8 medium, or large LOCA. Not "and". "Or". And that
9 was any one of them.

10 PARTICIPANT: Yes.

11 CHAIR APOSTOLAKIS: And then
12 frequencies.

13 You can just agree, Gareth. That's what
14 you mean. Small or medium or large.

15 MR. PARRY: You managed the sum. But I,
16 excuse me --

17 MR. CANAVAN: You mean the spectrum.

18 CHAIR APOSTOLAKIS: Yes.

19 MR. VANOVER: Yes. We added them up so
20 that's an or gate.

21 PARTICIPANT: Okay. Okay.

22 MR. CANAVAN: I always write the spectrum
23 of LOCA.

24 MR. PARRY: Make sure you capitalize LOCA.

25 MR. VANOVER: Okay.

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1 PARTICIPANT: Medium too.

2 PARTICIPANT: Yes.

3 MR. VANOVER: Moving forward to the model
4 uncertainty section now.

5 CHAIR APOSTOLAKIS: Where are you now?

6 MR. VANOVER: A-25 is the next. It's a
7 footnote for the identification of potential sources
8 of uncertainty in Table A-19.

9 CHAIR APOSTOLAKIS: So 8, footnote 8.
10 What is it in the tables?

11 MR. VANOVER: It's at the title to the
12 table.

13 CHAIR APOSTOLAKIS: Oh, it's at the title.
14 You're right. Of Table 19.

15 Internal events and internal floods
16 contributors that are potential sources of
17 uncertainty.

18 MR. VANOVER: Right. So we just wanted to
19 again emphasize that we didn't want to, for people to
20 use this as a template for their application with
21 those specific contributors. It's just --

22 MR. PARRY: Because this is a function of
23 the results that are driving the decision.

24 MR. VANOVER: Yes. That's one of the
25 focuses we talked about at lunchtime about the

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1 workshop. We want, You know, the intent of the
2 workshop is to make sure people understand that they
3 have to understand the contributors first. And and
4 that's part of the process to get to identify the
5 source, the potential sources of uncertainty.

6 CHAIR APOSTOLAKIS: Is the general
7 approach the following? Forget about -- something
8 that we discussed I think with Doug a few years back.

9 I have a PAR model or a sub-model for whatever I want
10 to do. And I know I have model uncertainty and human
11 error, for example. I thought a clever way of
12 handling it, if it works, because it doesn't always
13 work, is to say how high should that particular
14 probability be to change my decision? Because I'm
15 about to make a decision. Right? And then you find
16 that it has to be say higher by a factor of a hundred.

17 And then you say, but that's unreasonable. It can
18 not be greater, as great as, you know, as a hundred
19 times more. Is that spirit still there? I thought it
20 was a good idea to do that. Because, then you are
21 avoiding the issue of, gee, the model uncertainty is a
22 factor of three. No. It's a factor of five. Well
23 maybe it's two and a half. In other words, you are
24 focusing on the decision itself. Now that doesn't
25 mean it always work. But many times it does. Is it

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1 clear what I'm saying?

2 MR. PARRY: Yes. Yes. You want to back
3 out the --

4 CHAIR APOSTOLAKIS: How high does this
5 have to be to change the decision? And then you make
6 a judgement. If it, if by increasing by a factor of
7 two you change the decision, you say wait a minute
8 now. I'm not on solid ground here. But if it takes a
9 factor of a hundred, obviously, that's not validated
10 more.

11 MR. TRUE: No, I think it's in there. I
12 think that, but it's not, I wouldn't say that that's
13 necessarily emphasized. There's a there's a first
14 pass, I think section 5 --

15 MR. PARRY: Yes.

16 MR. TRUE: -- talks about using this raw
17 MACCS process where you you just assume something has
18 failed. See how large it is. If that exceeds your
19 acceptance criteria, then if it doesn't exceed your
20 acceptance criteria you can stop. When you're gain
21 the picking sensitivity studies, we tended to
22 emphasize, well 1174 emphasizes which is reasonable
23 alternative hypothesis. Looking at what's what you've
24 assumed your analysis. Look at what a reasonable
25 alternative is. And adopt that reasonable

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1 alternative. Rather than the way you're talking about
2 which is working backwards from the decision.

3 CHAIR APOSTOLAKIS: But the problem that,
4 with that is that, there may be endless discussions as
5 to what is a reasonable alternative.

6 Whereas, if you focus on the decision
7 first, the disadvantage of that is that you may not
8 always get a clear cut answer. In other words, it's
9 not always a factor of a hundred.

10 Maybe a combination of the two. I don't
11 know. But but --

12 MR. TRUE: I know from personal experience
13 I've I've done what you've said. And actually in
14 previous LARS. Where I've said, you know, "This can't
15 be a problem because it would have to be this big.
16 And there's no way it will ever be that big." But I
17 will, I don't believe we actually did that --

18 MR. VANOVER: No. We did that -- it's the
19 difficulties that we've entered with the incorporation
20 of more hazard groups and more quantifiable models.
21 Is that, unless we have an integrated model that
22 combines them all, we'd have to figure it out on the
23 side somehow, what the maximum increase would could
24 be. And then there's, for this example, there's
25 several calculations that have to be done. It's not

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1 just CDF related. It's delta CDF. It's a function of
2 the outage time. And you have the A loop out, the B
3 loop out. Those are separate calcs. So, even for
4 this one example, there's four separate case runs for
5 the base case. And then to integrate them with what -
6 - we could do it, but it's not as trivial as one
7 calculation. Figure it out.

8 CHAIR APOSTOLAKIS: Well, it doesn't have
9 to be trivial. I mean, it doesn't have to be one
10 calculation.

11 The question is, I think it is easier, in
12 general, to focus on how, what would it take to change
13 the decision, then argue that this is a reasonable
14 alternative model. In general, that's my impression.

15 That it is easier --

16 MS. DROUIN: Well, and I think that's in
17 there. Because you're doing it, you know, against
18 your acceptance guidelines. And to challenge your
19 acceptance guidelines where you're now would be
20 changing your decision, you know, it may take a factor
21 of a thousand or in some cases it may be just a little
22 bit. So, it's always going to be in the context of
23 looking at, what that change would need to be to
24 challenge your acceptance guidelines that you're using
25 for that decision.

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1 CHAIR APOSTOLAKIS: The question is, is
2 that message here somewhere?

3 MS. DROUIN: Oh, I think it is.

4 MR. PARRY: It is in Chapter 5. I think
5 it's less obvious in this.

6 MR. TRUE: Yes.

7 CHAIR APOSTOLAKIS: In the example I don't
8 think it is. In the main report -

9 MR. PARRY: In the main report, it is.
10 Yes. Yes.

11 CHAIR APOSTOLAKIS: -- you do talk about
12 it.

13 MR. TRUE: I think qualitatively Don has
14 it going places where he made arguments along those
15 lines. But never quantitatively.

16 CHAIR APOSTOLAKIS: Maybe that's something
17 you revisit in the future. Because I don't think it's
18 something we're going to settle today.

19 MS. DROUIN: But I think that's --

20 CHAIR APOSTOLAKIS: It's something that
21 requires some thinking.

22 And I'll tell you where else it appears,
23 in future reactors, in your technology neutral
24 framework. There is some guidance that says that,
25 "Sequences that have a point estimate less than 10 to

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1 the minus 8 or the 95th percentile less than 10 to the
2 minus 7." You didn't use those words. But they're
3 really below concern. You did use those words. I I -
4 -

5 That's where, again, with model
6 uncertainties and all that, you may want to argue.
7 You know, I have this sequence, it is already down
8 there. But somebody questions the model you use, then
9 you say, "Well, gee, it would have to be a factor of a
10 hundred to reach that level." It makes a hell of a
11 difference, you know, whether you include it in the
12 licensing basis events or not. So it's something that
13 is long term.

14 I I I I agree that it's in the main body.
15 I don't think it's explicitly stated in the example
16 in the appendix. But I don't think this is the time
17 to worry too much about it.

18 But I think in the future we have to go
19 back and revisit that. In other words, make all these
20 sensitivity analyses focused on the actual decision.

21 MR. PARRY: I actually think it's a not
22 feasible approach for things like SDP calculations
23 because they're very limited. And you have limited
24 number of uncertainties. And I think it can be very
25 valuable there.

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1 CHAIR APOSTOLAKIS: Yes. And and and my
2 point here is that, it's something that will require
3 some thinking. That's why I don't want you to come up
4 with something right now.

5 MR. SHACK: Well, it may be that what you
6 finally, when you finally have identified your key
7 sources of uncertainty, you now limited it down to a
8 small number.

9 CHAIR APOSTOLAKIS: Yes.

10 MR. SHACK: And you can begin to apply
11 arguments like that.

12 MR. TRUE: That's --

13 MR. SHACK: I think Don's argument before
14 that you have all this stuff together --

15 MR. PARRY: Yes.

16 MR. SHACK: -- and it's hard to do, if
17 you've got a lot of uncertainties it's hard to make
18 that kind of argument with a large number. You can
19 make a different set of arguments to get down as they
20 do in this in this example when they're down to two
21 key sources of uncertainty then you can begin to ask
22 yourself --

23 PARTICIPANT: Right.

24 MR. SHACK: -- that kind of a question.

25 PARTICIPANT: Yes.

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1 CHAIR APOSTOLAKIS: Not only that, but
2 that's why I'm saying that it really has to go through
3 some serious thinking. There was a table, I remember,
4 or two tables. But one came from Doug, I believe.
5 Where there was a generic list of model uncertainties.

6 MS. DROUIN: Right.

7 MR. TRUE: We still have that.

8 CHAIR APOSTOLAKIS: That can be expanded,
9 say, you know, this is a model uncertainty could be as
10 high as this. And then by combining the two, the
11 specific analysis with the generic table, you may
12 reach a conclusion.

13 MR. PARRY: You can only do that though if
14 you can directly relate it to a parameter. Some of
15 these things are not.

16 CHAIR APOSTOLAKIS: Not necessarily. Not
17 necessarily. Not necessarily.

18 MR. PARRY: I don't know how you can do
19 that with say --

20 CHAIR APOSTOLAKIS: I don't want to settle
21 the issue now, guys.

22 MS. DROUIN: Yes.

23 CHAIR APOSTOLAKIS: I mean, I don't think
24 it's something that we can start speculating. All I'm
25 saying is, this is something that, at least I think is

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1 worth some thinking, you know, in the privacy of your
2 offices. Not in the public forum.

3 MS. DROUIN: No, I, one of the things that
4 I have as part of the workshop is that at the end of
5 the workshop to set aside an hour with the
6 participants and get their feedback, you know, in real
7 time. You know, what are their ideas in terms of
8 where we should go.

9 And preparing for that outward discussion
10 at the workshop, our intent is to include a list of
11 questions. You know, instead of just this discussion
12 being a free-for-all. You know, there's specific
13 things that we would like to get their input on. And,
14 so, we would have that list of questions that we would
15 want them to think about during the course of the
16 workshop.

17 So when we get to the tallying, you know,
18 well what about maybe pursuing something like that.
19 We don't have all these questions formulated yet. But
20 I think this is --

21 MR. BLEY: That idea of having those
22 questions to focus in a discussions, that worked very
23 well on --

24 CHAIR APOSTOLAKIS: You do --

25 MR. BLEY: -- the initial framework.

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1 MS. DROUIN: Yes.

2 CHAIR APOSTOLAKIS: -- you do touch upon
3 it in Chapter 5. I can not go, become more explicit.

4 MS. DROUIN: No, it's --

5 CHAIR APOSTOLAKIS: -- the federal laws.

6 MR. PARRY: Would you like us to explain?
7 To mention the paper?

8 CHAIR APOSTOLAKIS: That's exactly what it
9 does.

10 MR. PARRY: Yes. I know exactly what it
11 does. And and and that is discussed in Chapter 5.

12 CHAIR APOSTOLAKIS: I know.

13 MR. PARRY: Yes.

14 CHAIR APOSTOLAKIS: I know. All I'm
15 saying is --

16 MR. PARRY: Yes.

17 CHAIR APOSTOLAKIS: -- I'd like to see
18 growth perspective in how far this argument is going
19 to be pushed.

20 MR. PARRY: Okay.

21 CHAIR APOSTOLAKIS: Which is, by the way,
22 Doug's approach was very, very similar.

23 MR. PARRY: Right.

24 MS. DROUIN: Okay.

25 MR. BLEY: Before we leave this I have a

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1 point of clarification. Because I've been back
2 through this again this morning. I haven't been at
3 it awhile. And now something that I don't remember
4 from the main report. This table has all together
5 about six items.

6 MS. DROUIN: Are you talking about Table
7 A-19?

8 MR. BLEY: Yes.

9 MS. DROUIN: Okay.

10 MR. BLEY: The whole table has some more
11 items that were culled from --

12 MS. DROUIN: Right.

13 MR. BLEY: -- looking through the
14 contributors and deciding what is --

15 MR. PARRY: Right.

16 MR. BLEY: -- important. It looks to me,
17 and I don't remember if there is guidance on this, and
18 I'm wondering what the argument is, it looks to me
19 like the top ten cut-sets for each of the two cases
20 pick up about ten percent core damage frequency. And
21 it looks, I can't say anything like that about the
22 next table, that looks at the contributors in terms of
23 their importance.

24 PARTICIPANT: Yes.

25 MR. BLEY: I don't have a clue how much

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1 how much of the core damage frequency we have there.
2 So two parts to this question. One is, is that a
3 reasonable number to be confident in the, why is that
4 a reasonable number to be confident that our
5 collection of items in to this Table is pretty good?
6 And two, would it have been helpful to also have a
7 sort based on risk achievement or if to see if there
8 was something hiding out that could really kick this?
9 And if there was uncertainty associated with that
10 that might be important.

11 MR. VANOVER: I I I can try to answer that
12 question. The the insights were mostly obtained from
13 the Fussil-Vasily contribution. The percent
14 contribution to the risk metrics.

15 MR. BLEY: Mm-hmm.

16 MR. VANOVER: We we provided the ten cut-
17 sets just as example. But --

18 MR. BLEY: Okay.

19 MR. VANOVER: -- because we didn't want to
20 put a whole --

21 MR. BLEY: Do you have a clue as to how
22 much of the core damage frequency we get with that
23 group?

24 MR. VANOVER: The group --

25 MR. BLEY: That are --

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1 MR. VANOVER: -- well each are --

2 MR. BLEY: -- that are listed by their
3 Fussil-Vasily importance. You can't add up those
4 importance.

5 MR. VANOVER: You can't add them up. But
6 they're they're all, you know, at least above five
7 percent. Some of them are in the 30 percent range, I
8 think.

9 MR. BLEY: Yes. Well, yes.

10 MR. PARRY: Yes.

11 MR. VANOVER: So we're picking up a large
12 contribution. The the risk achievement worth, we
13 could look at, but that's going to be the same type of
14 stuff that always shows up. The the rare event.

15 CHAIR APOSTOLAKIS: Fussil-Vasily doesn't
16 use percentage, does it?

17 MR. BLEY: It tells you the contribution
18 that cut-sets to core damage frequency.

19 MR. PARRY: A basic event. I'm sorry.
20 Not a basic event.

21 MR. BLEY: Whatever the event. Yes. If
22 it's a basic event.

23 MR. TRUE: I think there's another aspect
24 of this which is probably more, a little bit implicit,
25 but we also looked at the results in terms of action

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1 classes that contributed.

2 PARTICIPANT: Mm-hmm.

3 MR TRUE: And initiators that contributed,
4 you know. To make sure that we had sliced and diced
5 the results in different ways. Because if you get too
6 myopically focused on either importance majors or just
7 down in the cut-sets, you can miss the forest for the
8 trees.

9 MR. BLEY: Yes. So looking at the forest
10 that would help. I didn't see any texts that talked
11 about, that you did that. Is that in there?

12 MR. TRUE: That's up in the front. It's
13 actually before that. You know, our characterization
14 of, where are the risk from having RHR out of service
15 comes from. And then the most --

16 MR. BLEY: Oh, that was in the very
17 beginning.

18 MR. TRUE: The very beginning. Yes.

19 PARTICIPANT: When you're looking at the -
20 -

21 MR. TRUE: Yes. And these all logically
22 fall from that. Now don't -- we didn't do an
23 accounting what fraction of we got from that. But
24 these are, the logical differences.

25 MR. BLEY: That's helpful to me to to

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1 thinking taking that larger look kind of confirms that
2 we've picked up the important things.

3 MR. TRUE: And that's --

4 MR. BLEY: It would be nice. I don't
5 remember if the main report gives you much guidance on
6 how thorough you ought to be.

7 MR. PARRY: Maybe not on how thorough you
8 ought to be.

9 MR. DROUIN: No.

10 MR. PARRY: But it does discuss that
11 that's what you need to do.

12 PARTICIPANT: Yes.

13 MR. PARRY: Is you need to break it down
14 by contributors and then look at the cut-sets, the
15 individual contributors.

16 MR. BLEY: There is at least to me as I
17 read this, the impression I got reading this last part
18 that finally generated the Table, implied to me that
19 it all came from the ten cut-sets or the twenty cut-
20 sets, the top twenty in cut-sets. Ten in each case.
21 And this importance thing.

22 MR. TRUE: -- more the importance --

23 PARTICIPANT: Yes.

24 MR. BLEY: So that's the impression I got.
25 And I'm wondering if other people get that and if

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1 it's worth a --

2 MR. PARRY: Okay.

3 MR. BLEY: -- a note in the text to
4 clarify something along the lines that you guys just
5 talked.

6 MR. PARRY: I can see where you get that
7 sense.

8 MR. TRUE: You can see where you get that.

9 MR. PARRY: Yes. No, there's a sentence
10 there that is misleading. You're right. On A-22 it
11 says, "The review of the top level contributors in
12 these Tables."

13 MR. BLEY: Yes. That's what --

14 MR. PARRY: No. We need to we need to fix
15 that.

16 MR. BLEY: I would like you to fix that.

17 MR. PARRY: We will fix that. That's a
18 good that's a good catch because that's not what was
19 done. Yes. These --

20 MR. BLEY: Because then I started counting
21 things up. And I wasn't convinced.

22 MR. PARRY: You wouldn't even you wouldn't
23 even see a lot of the contributors in these texts.

24 PARTICIPANT: You don't?

25 MR. PARRY: You don't actually. No. We

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1 only intended these as examples. We'll need to beef
2 that up.

3 CHAIR APOSTOLAKIS: So where are we now
4 gentleman and ladies?

5 MR. BLEY: I've asked them to make a
6 little fix to that.

7 CHAIR APOSTOLAKIS: I understand that.
8 But which page are we on?

9 MR. VANOVER: I think we can move to page
10 A-33, Mary. The next --

11 MS. DROUIN: Yes. I agree.

12 CHAIR APOSTOLAKIS: A-33.

13 MR. BLEY: And we're skipping those very
14 long Tables.

15 MR. PARRY: Yes.

16 MS. DROUIN: Yes.

17 MR. PARRY: Well nothing changed.

18 MR. BLEY: Those are all the same.

19 MR. VANOVER: Some minor internal changes,
20 but --

21 MR. PARRY: Right. Yes.

22 MR. VANOVER: -- nothing to address the
23 ACRS comments. Okay.

24 The middle of page A-33, we tried to add
25 clarification, you know, not to construe this as a

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1 generic disposition for everybody. The conservatives
2 and the fire modeling.

3 MR. TRUE: I think there was a specific
4 ACRS reference to fire modeling and it's not being
5 acknowledged as a source of model uncertainty. What
6 we didn't say was that when you looked at the
7 scenarios that were driving the LOOP risks, we
8 actually didn't use any fire modeling in those
9 analysis of those scenarios. So we --

10 MR. BLEY: And that's what you're trying
11 to cover.

12 MR. TRUE: Yes. That's what we were
13 trying to cover in the text. And then as Don said,
14 the footnotes say, "You can't generically conclude
15 that."

16 MR. BLEY: Yes. Because there's two
17 things in the Table. You didn't get the convincing
18 part about that. So I think this helps.

19 CHAIR APOSTOLAKIS: And this is where, in
20 the future, you really want to worry about the
21 physical models.

22 PARTICIPANT: Mm-hmm.

23 MS. DROUIN: Right.

24 MR. PARRY: Yes. You've done some work on
25 that. Right, Ken? On fire model --

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1 MS. DROUIN: Unless we want to go through
2 more of these footnote type of Tables. We can jump
3 all the way to page A-46.

4 MR. PARRY: No. No. Go to A-34.

5 MR. VANOVER: A-34. Yes. We just got rid
6 of that footnote.

7 MR. BLEY: That's a different footnote.

8 MR. VANOVER: This was the parametric
9 uncertainty evaluations.

10 MS. DROUIN: Yes.

11 MR. VANOVER: It was noted that there was
12 not much difference. And we just, that that's what
13 happened in this case. That may not be the case in
14 all applications. The epistemic correlation.

15 MR. SHACK: That's the belt and the
16 suspenders. Could you say that in the first paragraph
17 too? I mean --

18 MR. VANOVER: Yes.

19 MR. PARRY: Yes.

20 MS. DROUIN: And I want to point out that
21 we quit using the term "state of knowledge".

22 CHAIR APOSTOLAKIS: You did what?

23 MS. DROUIN: We quit using the term "state
24 of knowledge".

25 PARTICIPANT: Oh and that funny acronym --

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1 PARTICIPANT: Thank you. Thank you.

2 CHAIR APOSTOLAKIS: Which, for these kinds
3 of calculations, which codes does the industry use?

4 MR. TRUE: CAFTA.

5 MR. CANAVAN: UNCERT.

6 PARTICIPANT: It's a module in --

7 MR. CANAVAN: In the module. It's UNCERT.

8 It's a module in CAFTA.

9 CHAIR APOSTOLAKIS: It's CAFTA.

10 MS. DROUIN: CAFTA.

11 MR. TRUE: I would also say --

12 MS. DROUIN: He's long dead.

13 MR. TRUE: -- at my own peril. I think
14 that what, actually found pragmatically in doing an
15 analysis of plant PRAs and applications, is that,
16 this result is actually not all that uncommon.

17 PARTICIPANT: No.

18 MS. TRUE: That that the, what the
19 standards, the requirements for gathering plant
20 specific data which we've now brought in to end up
21 with different distributions for different the
22 parameters. Better treatment of common cause. All
23 those these, that the epidemic correlation is not as
24 significant at the CDF level. There may be slices of
25 it like ice mocha and some other ones where some are

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1 very important. But at the CDF level, delta CDF --

2 CHAIR APOSTOLAKIS: How much time does
3 that save Doug?

4 MR. TRUE: I'm not I'm not arguing, I
5 already know it saves time. I'm just saying that just
6 for your thing.

7 CHAIR APOSTOLAKIS: I know I know I know
8 what you're saying is --

9 MR. TRUE: But this plant model will
10 probably be there with almost every application.
11 Because this is literally this is what we see
12 pragmatically when we when we do this. I'm not
13 arguing against doing the calculation. I gave that up
14 a long time ago. Despite the fact that it's a waste
15 of time.

16 (Laughter.)

17 MS. DROUIN: Okay. Moving on.

18 MR. VANOVER: Okay. The presentation of
19 the sensitivity study results to address the third ACS
20 comment --

21 CHAIR APOSTOLAKIS: Page?

22 MR. VANOVER: A-45.

23 CHAIR APOSTOLAKIS: 45.

24 MR. VANOVER: And this sort of addresses
25 George's earlier comment that we, you know, we, you,

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1 sometimes you can do a conservative screening study
2 and and use a maximum bounding increase. And in other
3 cases you need to do a more reasonable alternative
4 assessment in presenting the results. So we added
5 that footnote to the title of the Table.

6 CHAIR APOSTOLAKIS: This 95th percentile,
7 guys, I mean, it bothers me.

8 MR. PARRY: Which Table are you on?

9 MR. TRUE: 46.

10 CHAIR APOSTOLAKIS: 46. In this example
11 application, "All HEP events are set to their 95th
12 percentile value." I don't know what that means.

13 MR. PARRY: Well, okay. That that's just
14 the way this was done. Okay. So, okay.

15 But the next paragraph, the remainder of
16 that paragraph explains why we think in this case that
17 that's okay. Because of the way we used it.
18 Essentially, what we're saying is that, if the PRA
19 has, and this PRA has been done and peer reviewed
20 against the standard, and we do believe that the
21 relative ranking of the HEPs is is acceptable and
22 wasn't incorrect, because who knows, but it's it's
23 consistent with the way the standard will be done.
24 What we're really worried about is is maybe the
25 overall level of the HEPs.

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1 And this is a, I think this is a way that
2 we've dealt with this issue in lots of other examples
3 like in NEI 00-04, for example.

4 Now in the main body of the text, yes, we
5 do say that, "You should look at the variability
6 between methods as well as well as within the method."

7 In this case though, what we said was, "Just by even
8 looking at these, the range that it, the factor that
9 it increases is in the range of 2 to 4 for all the
10 HEPs in this particular model." And it's sufficient
11 really to show that some of these human actions are
12 significant. And therefore, they are candidates for
13 compensatory measures. And that's the way we are
14 using it in this context.

15 CHAIR APOSTOLAKIS: Okay. They are
16 significant. Now what?

17 MR. PARRY: Then you identify the
18 compensatory measures for these.

19 CHAIR APOSTOLAKIS: So let let me
20 understand the Table.

21 MR. PARRY: Okay.

22 CHAIR APOSTOLAKIS: Because it's been a
23 long time.

24 MR. PARRY: Okay.

25 CHAIR APOSTOLAKIS: That's page 46.

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1 Right?

2 MR. PARRY: Yes.

3 CHAIR APOSTOLAKIS: So the first column
4 says, "Human error probability development, note one.
5 Total delta CDF." Is that after you have used the
6 95th percentile or before?

7 MR. VANOVER: That's after. It does this
8 this whole Table is the result of the sensitivity
9 studies.

10 CHAIR APOSTOLAKIS: Okay. So I have
11 raised -- so what was delta CDF before you did that?

12 MR. VANOVER: Right, like it's presented
13 in the beginning of that Table. The base case
14 assessment.

15 CHAIR APOSTOLAKIS: So it was 2.7 10 to
16 the minus 7.

17 MR. VANOVER: Right.

18 MR. PARRY: Right.

19 CHAIR APOSTOLAKIS: So it increased by
20 roughly a factor of five, less than five.

21 MR. PARRY: Four four pretty much. Just
22 under four.

23 CHAIR APOSTOLAKIS: And it's now 10 to the
24 minus 6.

25 PARTICIPANT: Mm-hmm.

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1 CHAIR APOSTOLAKIS: And what was the
2 regulatory limit?

3 MR. PARRY: 10 to the minus 6.

4 CHAIR APOSTOLAKIS: For CDF?

5 MR. PARRY: Delta CDF.

6 MR. TRUE: Right. We are staying in a
7 very small range.

8 MR. PARRY: Region 3.

9 MR. TRUE: Region 3.

10 MR. SHACK: He doesn't want to go --

11 CHAIR APOSTOLAKIS: But you can go to 10
12 to the minus 5. Can't you?

13 MR. SHACK: -- he doesn't want to go
14 there.

15 MR. PARRY: You can but --

16 CHAIR APOSTOLAKIS: Why don't you want to
17 go there?

18 MR. TRUE: Because then we would have to
19 quantify the base, we'd have to quantify base
20 everything.

21 MR. PARRY: Including low power shutdown,
22 seismic --

23 MR. TRUE: To demonstrate that we're below
24 10 to the minus 4.

25 MR. SHACK: Region 3 spreads out. Region

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1 5 steps it 10 to the minus 4.

2 CHAIR APOSTOLAKIS: Let's just say for the
3 moment that we ignore that.

4 By increasing this human error probability
5 by a factor of 2 to 4, I go to 10 to the minus 6. By
6 how much would I have to increase it to go to 10 to
7 the minus 5?

8 MR. VANOVER: If we scaled it, than a lot.

9 MR. TRUE: You can't do that.

10 CHAIR APOSTOLAKIS: Why can't --

11 MR. TRUE: Well because it --

12 CHAIR APOSTOLAKIS: -- I do that?

13 MR. PARRY: No. You can't do it. Yes,
14 because --

15 MR. TRUE: They're synergies. Because
16 some cut-sets have more than one basic --

17 CHAIR APOSTOLAKIS: That's right. That's
18 right.

19 MR. TRUE: So --

20 CHAIR APOSTOLAKIS: So it would be a
21 significant increase then. Would it not?

22 MR. TRUE: No. It might, it went up by a
23 factor of 4. And we needed it to go by a factor of
24 40. It could be as small --

25 MR. VANOVER: Well we we --

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1 MR. TRUE: -- as a factor of 10.

2 MR. VANOVER: -- also the model also
3 includes a dependency analysis.

4 CHAIR APOSTOLAKIS: I'm sorry. What?

5 MR. VANOVER: A human error dependency
6 analysis. So there's already a lot of, where human
7 events appear in the same cut-set, we've already made
8 a single event to model the combined failure. And
9 those got adjusted in this sensitivity as well.

10 MR. PARRY: Let me try to get to George's
11 point. Are you asking, George, how much would you
12 have to increase the HEPs to trigger 10 to the minus
13 5?

14 CHAIR APOSTOLAKIS: Right.

15 MR. PARRY: Yes. We can't answer that. I
16 mean, these factors of 2 to 4, they're different for
17 the different HEPs. Okay. Some of them go up by a
18 factor of about 4. Some of them go up by a factor of
19 2 depending on where they are. So it's not an easy
20 question, it's certainly not a question we can answer
21 here.

22 CHAIR APOSTOLAKIS: It's not a question to
23 be answered here, but it can't be that difficult.

24 MR. VANOVER: Trial and error.

25 MR. PARRY: Trial and error. Yes.

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1 MR. TRUE: You'd have to just pick some
2 numbers and --

3 CHAIR APOSTOLAKIS: But is it a factor of
4 six?

5 MR. TRUE: No.

6 MR. PARRY: No. Smaller than that.

7 MR. TRUE: Probably over ten, I would
8 guess.

9 MR. PARRY: Probably over ten. Yes.

10 MS. DROUIN: But since you're trying to
11 stay in the low region I'm not sure what would be the
12 exercise, what would be the benefit of doing that or
13 knowing that?

14 CHAIR APOSTOLAKIS: Oh it would be --

15 MS. DROUIN: The whole point is to stay in
16 the low region.

17 CHAIR APOSTOLAKIS: -- because a factor of
18 ten is a pretty significant factor. And if I'm still
19 below the 1174 limit --

20 MR. PARRY: Well, except that we don't
21 have a complete, we'd have to be sure that the CDF was
22 less than 10 to the minus 4.

23 CHAIR APOSTOLAKIS: In this case, it's
24 not?

25 MR. PARRY: We don't know. I mean, we

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1 just don't know. I mean, my feeling is, yes. But
2 almost certainly. But we don't have the numbers.

3 CHAIR APOSTOLAKIS: I mean, again, the
4 spirit of all these comments is not change this
5 particular example.

6 MS. DROUIN: Right. I understand.

7 MR. PARRY: Right. No. No.

8 CHAIR APOSTOLAKIS: I'm trying to find the
9 way of injecting this kind of thinking in to this kind
10 of argument. Because if it's more than a factor of
11 10, that clearly tells me something.

12 MR. PARRY: Yes.

13 CHAIR APOSTOLAKIS: That maybe I should
14 worry about it.

15 MR. PARRY: That maybe you should about
16 it. Yes.

17 MR. CANAVAN: This is the old argument
18 about, for example, if you make a decision and the
19 base decision comes out to 80 to the minus 7, and you
20 run an uncertainty, and when you're running that case
21 a factor of 67 on a HEP brings you to brings you in to
22 the next category, you might argue that that 67 is
23 too high to get.

24 CHAIR APOSTOLAKIS: It's an unreasonably -
25 -

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1 MR. CANAVAN: It's an unreasonably high
2 number.

3 CHAIR APOSTOLAKIS: -- yes.

4 MR. CANAVAN: So therefore, I'm confident
5 that --

6 MR. TRUE: An unreasonable alternative --

7 MR. CANAVAN: -- the unreasonable
8 alternative hypothesis, but it remains in the small
9 category. Not in the unacceptable range. So you might
10 argue that your's is small --

11 CHAIR APOSTOLAKIS: It's a very useful
12 insight it seems to me.

13 MR. CANAVAN: -- category.

14 MR. PARRY: It is when it's applicable.
15 But in this case --

16 CHAIR APOSTOLAKIS: In this case --

17 MR. PARRY: -- it's not that.

18 MR. BLEY: And if you start making that
19 argument, you got to start thinking about what are the
20 things that could drive those human error
21 probabilities. And it's it's not multiplying by a
22 number. It's something going on probably --

23 PARTICIPANT: Right.

24 MR. BLEY: -- in the way the plant's
25 operated or people are trained and --

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1 CHAIR APOSTOLAKIS: Presumably you have
2 already done that. That's why you were reporting
3 HEPs. I mean, it's not like you were pulling a number
4 out of --

5 MR. SHACK: I mean, after you've done that
6 you still have to quantify it then. That's really
7 what he's really arguing about. That final numerical
8 --

9 PARTICIPANT: Yes.

10 MR. CANAVAN: There's some insight that
11 can be gained from that number, but --

12 CHAIR APOSTOLAKIS: I mean, it was a
13 common cause failure too. In an example we did some
14 years ago people say, well, common cause failures are
15 models and all that. But then if you see that, you
16 know, the beta, gamma, and all that stuff, you really
17 have to go almost close to one for the decision to be
18 reversed. Then you say, "Wait a minute now."

19 MR. PARRY: Yes.

20 CHAIR APOSTOLAKIS: I mean, that that's
21 that's unreasonable.

22 MR. PARRY: Yes.

23 CHAIR APOSTOLAKIS: We don't see that in
24 practice.

25 MR. BLEY: But is it unreasonable to say

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1 to apply those across systems which we don't usually
2 do? That might make a really big difference.

3 MR. PARRY: That could make, that would
4 make a really big difference.

5 CHAIR APOSTOLAKIS: It might.

6 MR. PARRY: I think it would.

7 MR. BLEY: When you start on these grand
8 conclusions you got to start thinking about lots of
9 breakers and factors.

10 MS. DROUIN: But the fact is --

11 CHAIR APOSTOLAKIS: all I'm saying is,
12 this is another way of attacking or giving insights in
13 to the model uncertainty issue.

14 MR. PARRY: Right.

15 MR. VANOVER: Right. In a in a different
16 example where --

17 CHAIR APOSTOLAKIS: By the way, it's one
18 way that gives additional insight.

19 MR. PARRY: Right.

20 CHAIR APOSTOLAKIS: That's all.

21 MR. VANOVER: If the example were
22 presented that was far away from the acceptance
23 guidelines, then it would be a little bit easier to do
24 that kind of calculation --

25 MR. PARRY: Yes.

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1 MR. VANOVER: -- and and have confidence
2 there. In this example we're close to the acceptance
3 guidelines.

4 CHAIR APOSTOLAKIS: Well, you're 10 to the
5 minus 6.

6 MR. PARRY: Yes.

7 MR. VANOVER: Well, even if, we're before
8 the --

9 PARTICIPANT: The base --

10 MR. VANOVER: -- the base case.

11 CHAIR APOSTOLAKIS: Yes.

12 MR. VANOVER: So what we're, the the point
13 at that point is, okay, what's, I'm I'm close.
14 Granted, I'm close, but I think I'm okay. And
15 therefore, what's important to the decision being
16 made. And that, and this sensitivity case reconfirms
17 that the list of actions that I've already identified
18 important didn't change.

19 MR. PARRY: Right.

20 MR. VANOVER: When I -- by looking at the
21 results of the sensitivity case.

22 MR. PARRY: Right. I think also to add to
23 that, I think this is a, and somewhat of a more
24 instructive example, because we are close to the to
25 the limit. Because if we were really low and all we

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1 did was show that you can multiply these by a factor
2 of ten, we think that's unreasonable, I I don't think
3 it's very helpful. Because then, so what? I mean, we
4 knew that anyway. But if if your decision is
5 insensitive to these uncertainties, you're really in a
6 very good place.

7 So now I think what we're showing here is
8 that by understanding the results and understanding
9 what's driving the uncertainty to towards the limit,
10 you can, at least, focus on things you might be able
11 to do something about. Which in this case is is doing
12 some compensatory measures on important human actions.

13 MS. DROUIN: Right. By my understanding,
14 George, your comment is not so much on this example.

15 CHAIR APOSTOLAKIS: No.

16 MS. DROUIN: But if we go back to the main
17 body and look at the guidance we have in there. And
18 if we start looking at, you know, get to the point
19 where we're starting to make a decision. There is
20 some additional insights by looking at it from this
21 perspective that could help us in making a decision.

22 Now, that may not be applicable for this particular
23 example. But in terms of the guidance that we have
24 provided to look and see, you know, what would it take
25 to get there. And getting there, would that be

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1 unreasonable. I agree that could add, that could that
2 could provide some very useful information in to your
3 decision making process. And I agree that down the
4 road we ought to look at what would that take in terms
5 of providing guidance from that perspective.

6 MR. PARRY: Right. I actually think
7 that's in Chapter 5. I think that's already in
8 Chapter 5. That guide.

9 CHAIR APOSTOLAKIS: It's in the potential
10 measures. Shouldn't one ideally go back and redo the
11 numbers assuming these are in place? Or take on faith
12 that if you do these things everything will be okay?

13 MR. PARRY: If we knew how to do that --

14 CHAIR APOSTOLAKIS: Well --

15 MR. PARRY: -- without human reliability
16 methods.

17 CHAIR APOSTOLAKIS: -- well, I don't know.

18 MR. SHACK: And what credit do you give
19 them for the pre-shift brief?

20 MR. PARRY: Then you do the best you can.

21 I mean, in a sense, we do think that the
22 values that are in here, the base values are, in fact,
23 good representative values.

24 Incidentally, just as a matter of interest
25 I went back and checked the SPAR models for this for

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1 this particular plant. They're not very different.
2 In fact, I think in some cases, the numbers in this
3 model are higher than a lot. You can't make a direct
4 one-to-one comparison because they define the HFEs a
5 little differently. But I think the HEPs that I saw,
6 quite a lot of them, were considerably higher than
7 what you would see in the SPAR model.

8 CHAIR APOSTOLAKIS: So you are saying that
9 you have to take it on faith that these compensatory
10 measures --

11 MR. TRUE: Compensatory measures get us
12 back to what we assumed is the base model without
13 those compensatory measures.

14 MR. PARRY: Right.

15 MR. TRUE: That keeps us below the
16 threshold. Right. Okay. Without the compensatory,
17 without without --

18 (Laughter.)

19 -- the base model the base model the base
20 model was okay. All right. We came in below the
21 threshold with the base assumptions. When we
22 increased the values, they went went went above.
23 We're putting in place those compensatory measures to
24 make sure we're down where we were to begin with.

25 MR. PARRY: At least.

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1 MR. TRUE: At least.

2 MR. PARRY: Yes.

3 MR. TRUE: And the those values that are
4 in the base value did not assume we had taken these
5 additional actions.

6 CHAIR APOSTOLAKIS: So the applicant then,
7 the licensee will tell the staff --

8 MR. PARRY: Right.

9 CHAIR APOSTOLAKIS: -- here is our
10 application. And we promised to do these things as
11 well.

12 MR. TRUE: Mm-hmm.

13 MR. PARRY: Yes.

14 MS. DROUIN: To offset the change we've
15 done over here to keep our risk down at the original
16 place.

17 MR. TRUE: This is not a new thing for the
18 staff or for LARs. We've done this since --

19 MR. PARRY: Right.

20 PARTICIPANT: Right.

21 MR. TRUE: -- late, early 2000 kind of
22 time frame when the first wave of things came through.
23 Where we would include compensatory measures based on
24 our insights from the results.

25 CHAIR APOSTOLAKIS: So you see, again, one

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1 way or another ultimately comes to a decision.

2 MR. PARRY: Yes.

3 PARTICIPANT: Yes.

4 PARTICIPANT: Right.

5 MR. TRUE: Providing confidence in that
6 decision.

7 PARTICIPANT: Yes.

8 MR. PARRY: Yes.

9 MS. DROUIN: Okay.

10 CHAIR APOSTOLAKIS: Well let's see now.
11 Where are we? How long do you need?

12 MR. VANOVER: The there's only one more --

13 MS. DROUIN: There's only one more.

14 MR. VANOVER: -- highlighted section and
15 it's one of the generic footnotes at the end.

16 CHAIR APOSTOLAKIS: 45?

17 MR. VANOVER: 48.

18 CHAIR APOSTOLAKIS: Okay.

19 MS. DROUIN: So then we're at the very
20 last slide of --

21 CHAIR APOSTOLAKIS: Future work.

22 MS. DROUIN: -- future work. As we talked
23 earlier in the briefing, you know, early April, we
24 plan to make this appendix, you know, which is coming
25 up next week.

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1 MR. BLEY: Did you already send out the
2 main document? You made that available?

3 MS. DROUIN: The main document is in the
4 publication process. And what that means is, it's
5 it's it's waiting. We sent a letter to the Program
6 Office saying, "We intend to publish." And we give
7 them two week notification. So we're at that part.
8 So, the end of next week, it will go to the printer
9 and be, will be publically available.

10 And at that time, is, I will, has been
11 planning on issuing a second public notice. And the
12 second, the public notice would have the ADAMS number
13 for the appendix in it with a detailed agenda of the
14 workshop.

15 CHAIR APOSTOLAKIS: Very good.

16 MS. DROUIN: So I don't see, except maybe
17 a few places, you know, that we agreed to today that
18 we will go back and make some, and these are minor,
19 not any major things that we have to, you know, fix on
20 this appendix to make it public from today's meeting.

21 Then in the July/August -- and those are
22 tentative dates. Based on the workshop and any
23 additional needed changes to formally to formally
24 publish this appendix as Volume 2. And the reason I
25 say July/August is just the process you have to go

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1 through, it's not going to happen overnight. So, to
2 me, it will probably be published in the July/August
3 time frame.

4 And then again, based on insights from the
5 workshop, from our users need, you know, identify what
6 our future work's going to be. You know, what will be
7 our short term and long term things, you know. What
8 additional examples we want to take on. Where we need
9 to expand the scope. You know, right there I just
10 have internal fire, new reactors. Things we will
11 consider, also, of course is level 2, level 3. I
12 mean, there's a whole slew of the things we need to
13 think about and what order, you know, we will we will
14 do them.

15 And, of course, we will continue back with
16 the ACRS on this.

17 CHAIR APOSTOLAKIS: The, is the NGNP still
18 in the works? It was in the law. I don't know -- are
19 they still going ahead?

20 MS. DROUIN: Well, there's the NGNP
21 licensing strategy that went to Congress.

22 CHAIR APOSTOLAKIS: Right.

23 MS. DROUIN: And they're having meetings
24 right now for the pre-application review.

25 CHAIR APOSTOLAKIS: Right.

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1 MS. DROUIN: And I believe the the license
2 review is supposed to start in 2013.

3 CHAIR APOSTOLAKIS: And it's supposed to
4 have a good dose of risk information. Correct?
5 That's what we recommended at least. And I hadn't
6 heard otherwise.

7 MS. DROUIN: It doesn't -- let me try and
8 answer it a different way. If you use as a point of
9 departure for comparison, they are not going to the
10 level of what is in the framework document.

11 CHAIR APOSTOLAKIS: Absolutely not. Yes.
12 But they are bringing a lot of risk information I
13 think in the in the --

14 MS. DROUIN: I think they would argue with
15 that. Their view is that it is, it is primarily
16 deterministic, with some insights, with some risk
17 insights factored on to it. But most of the decisions
18 are deterministic.

19 CHAIR APOSTOLAKIS: So it would be the
20 same like design certification or the PRA is just a
21 new kid in the block and we'd look at it in case we
22 find something. But essentially, the decision is --

23 MS. DROUIN: Well, I I --

24 CHAIR APOSTOLAKIS: What is the status of
25 the TNF within the agency now? Is it just a NUREG

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1 somewhere?

2 MS. DROUIN: It is a NUREG that has been
3 published. There is a second paper going forward that
4 will talk about a recommendation in terms of testing
5 the framework document. I don't know if you want to--

6 CHAIR APOSTOLAKIS: Testing it in the NGNP
7 or separately?

8 MS. DROUIN: There are different
9 approaches upon which you can test it. I I I don't
10 want to say too much because it's still pre-decisional
11 right now.

12 CHAIR APOSTOLAKIS: Okay.

13 MS. DROUIN: But you know, the fact there
14 is a second paper going forward that does talk about.
15 Because the Commission came back, you know, that's
16 all public, did come back and say, "Test the
17 framework."

18 CHAIR APOSTOLAKIS: Yes.

19 MS. DROUIN: And so there is a second
20 paper going forward with a recommendation of what it
21 would take to test the framework.

22 CHAIR APOSTOLAKIS: A test is a piece
23 information. There are a lot of people out there who
24 do like that. Who like the TNF.

25 MS. DROUIN: I'm aware of that.

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1 CHAIR APOSTOLAKIS: They think that's a
2 way to go.

3 MS. DROUIN: They may like it, but they
4 aren't stepping up as a volunteer.

5 CHAIR APOSTOLAKIS: To do what? To have
6 to reevaluate it. No. I think the NGNPs are not sure
7 of counting it. This would be a real real case. Now
8 we are getting out of the --

9 MS. DROUIN: But that's all we have.

10 CHAIR APOSTOLAKIS: Yes. Are there any
11 comments from the members? No? Said it?

12 MR. ABDEL-KHALIK: No.

13 CHAIR APOSTOLAKIS: Bill?

14 MR. SHACK: No.

15 CHAIR APOSTOLAKIS: Public?

16 MR. SHACK: I think the the the notes do
17 help clarify things. It may be a little overkill, but
18 --

19 PARTICIPANT: Yes.

20 MS. DROUIN: And and and I want to
21 apologize. Ken, I don't know if Ken wanted to add
22 anything.

23 MR. CANAVAN: There was only one item for
24 the record. George, in the beginning mentioned the
25 EPRI report and he mentioned the April version. But I

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1 just want to be clear that the the title was correct,
2 but the report number is 1016737 and the final report
3 is December 2008. Just so you have it.

4 CHAIR APOSTOLAKIS: We have that. Right?

5 MR. CANAVAN: Yes. You do.

6 CHAIR APOSTOLAKIS: Okay. Thank you. All
7 right. Thank you very much. This was very
8 informative. Appreciate it. Thanks.

9 (Whereupon, the above-entitled
10 matter was concluded at 2:40 p.m.)
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Treatment of PRA Uncertainties in Risk- Informed Decision Making

**Advisory Committee on Reactor Safeguards
Subcommittee on PRA**

March 27, 2009

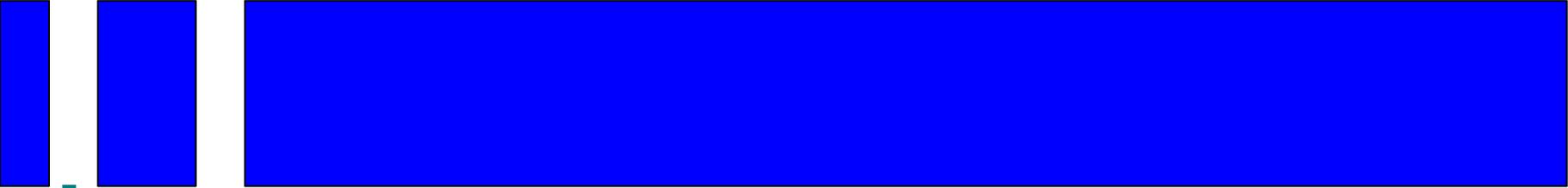


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Objective of Meeting

- Discuss staff resolution of ACRS comments on Appendix A to NUREG-1855
 - Overview of major comments
 - Walk-through of the revised document
- Future work



OVERVIEW OF MAJOR COMMENTS

ACRS Comment (1)

- ACRS Comment: Results are presented in ways that may be misinterpreted as general conclusions, when they are applicable only to the specific situation modeled.
- Staff Resolution: Added numerous statements, in footnotes, to highlight that the conclusions drawn are not to be interpreted as generic, but must be derived for each application independently.

ACRS Comment (2)

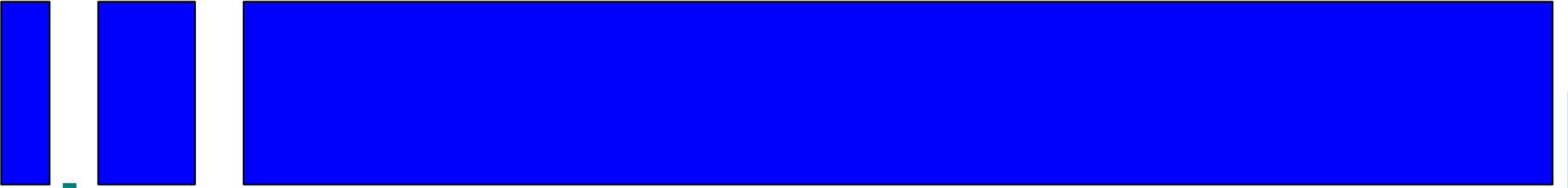
- ACRS Comment: Important seismic dependencies are not described in ways that make it clear that the user will need to identify and model them properly.
- Staff Resolution: Expanded the discussion of the seismic analysis to address the dependencies between seismically induced failures.

ACRS Comment (3)

- ACRS Comment: Concern with an apparent use of arbitrary sensitivity analyses to evaluate model uncertainties.
- Staff Resolution: Enhanced discussion to highlight the adequacy of the sensitivity analyses to identify the key sources of model uncertainty and to identify appropriate compensatory measures.

Additional Changes

- Several changes made to the report to clarify:
 - The definition of the application
 - The screening of low power and shutdown contribution
 - An evaluation of fire LERF is needed
 - The basis for considering fire PRA results conservative



WALK-THROUGH OF THE REVISED DOCUMENT

Changes on Pages --

A-1	.....	Clarification
A-4	.....	Applicability
A-6	.....	Clarification
A-9	.....	Clarification
A-11	.....	Applicability, Dependencies
A-14	.....	Applicability, Dependencies
A-15	.....	Applicability, Dependencies
A-25	.....	Applicability
A-33	.....	Applicability, Clarification
A-34	.....	Applicability
A-39	.....	Applicability
A-45	.....	Applicability
A-46	.....	Sensitivity
A-48	.....	Applicability

APPENDIX A

EXAMPLE IMPLEMENTATION OF THE PROCESS FOR THE TREATMENT OF PRA UNCERTAINTY IN A RISK-INFORMED REGULATORY APPLICATION

The license amendment request (LAR) discussed here is a hypothetical example developed to illustrate the process described in this document and in EPRI 1016737. While a realistic PRA model has been used in the example, it has been modified to ensure that there are some sources of uncertainty that exercise all aspects of the process (i.e., result in challenging the acceptance guidelines). The approach discussed for addressing these sources of uncertainty is provided as one example of a spectrum of possible approaches and is provided for discussion and illustrative purposes. Its inclusion should not be construed to imply that this is the only approach or that the illustrative example would be sufficient in all cases.

A.1 Introduction

This appendix provides an example of the implementation of the guidance given in this report. The example risk-informed regulatory application is a hypothetical License Amendment Request (LAR) to revise the Technical Specification Allowed Outage Time (AOT) from 3 days to 7 days for the RHR/SPC system at a representative BWR, Mark II plant. The PRA model for the plant is consistent with the PRA technical adequacy requirements outlined in Regulatory Guide 1.200 [Ref. A.1]. The purpose of the technical specification change is to allow routine preventive maintenance currently performed at shutdown to be performed with the unit at power. As discussed in Section A.3, the risk reduction associated with moving this maintenance unavailability from shutdown will be conservatively omitted from the calculation of Δ CDF and Δ LERF.

Following the guidance in Section 3.1 of this report, the first step is to identify the risk assessment results required to support the LAR using the application specific guidance documents. For this risk informed AOT Extension, the application specific guidance documents are Regulatory Guide 1.174 [Ref. A.2] and Regulatory Guide 1.177 [Ref. A.3]. The risk assessment or PRA results required for this application and the associated acceptance guidelines are summarized in Section A.1.

The remaining sections follow the guidance in Section 7 to document the analysis performed to assess the risk implications of the proposed LAR. Section A.3 provides a description of the PRA model used to support the analysis and summarizes how the PRA is used to generate the results required for comparison with the acceptance guidelines, and follows the guidance in Section 7.2. Section A.4 presents the comparison of the PRA results with the acceptance guidelines, following the guidance in Section 7.3 to address the PRA uncertainties. This in turn relies on the detailed guidance in Sections 4, 5, and 6. Finally, the presentation of the results is discussed in Section A.5, using the guidance of Section 7.4.

The example is not intended to be comprehensive in the treatment of completeness uncertainty. However, some examples are provided to illustrate the approaches that can be used.

These insights indicate the following when considering the scope of the PRA required to assess the risk significance of the RHR Loop AOT¹:

- Both the functions of Containment Heat Removal and RPV Makeup are relevant to the risk significance of the RHR Loops.
- LOCA, LOOP, and Transient initiators all have the potential to create a demand for the RHR Loops

Assessment of Relevant Hazard Groups

With an understanding of the role that the RHR system plays in mitigating risk an assessment of the relevant hazard groups can be completed. Section 6.3.3 provides a list of hazard groups that should be considered in a risk assessment. Table A-3 summarizes how those hazard groups were dispositioned for this hypothetical plant. The majority of the hazard groups were screened from consideration, using the screening approaches discussed in Section 6.

**Table A-3
HAZARD GROUPS CONSIDERED IN THE RISK ASSESSMENT**

Approach	Hazard Group	Basis²
Addressed quantitatively	<ul style="list-style-type: none"> • Internal Events • Internal Floods • Internal Fires 	Plant-specific PRA reflecting the as-built, as-operated plant is used to quantitatively estimate the risk impacts.
Addressed using a conservative approach	<ul style="list-style-type: none"> • Seismic Events 	Using a simplified conservative analysis, the contribution of seismic risk to total risk can be shown to be minimal.
Screened from consideration based on likelihood of threat-induced challenge	<ul style="list-style-type: none"> • Accidental Aircraft Impacts 	Removal of RHR Loop may decrease reliability of heat removal function, but the frequency of damage from accidental aircraft impacts is very small compared to other events already considered (e.g., LOOP, Loss of Condenser)
	<ul style="list-style-type: none"> • External Floods 	A slow developing event which would allow restoration of out of service RHR Loops prior to presenting a significant challenge.
	<ul style="list-style-type: none"> • Extreme Winds and Tornadoes (including generated missiles) 	Plant is designed for extreme winds and tornadoes. Removal of RHR Loop may decrease reliability of heat removal function, but the frequency of wind/tornado-induced damage is very small compared to other events already considered (e.g., LOOP, Loss of Condenser)

¹ The conclusions related to the relevance of RHR to plant risk are specific to the plant and change being evaluated and are not be construed as generic dispositions.

² The conclusions related to the relevance of these hazard groups to the application are specific to the plant and change being evaluated and are not be construed as generic dispositions of the hazard group.

The at-power PRA models used for this analysis therefore include:

- an internal events,
- an internal floods, and
- a fire PRA model.

In addition, the seismic hazard group was addressed quantitatively with a conservative analysis as discussed in Section A.3.4. The other hazard groups were demonstrated not to be relevant based on a screening analysis. The at-power Δ CDF and Δ LERF for this application are such that the results lie in Region III of the RG 1.174 acceptance guidelines (see section A.3.3), and therefore, it is unnecessary to evaluate the low-power and shutdown contribution to the base CDF and LERF. Furthermore, the change being proposed involves moving unavailability of the RHR loops from shutdown to power conditions. The analysis will conservatively omit this risk reduction, which could be used under RG 1.174 to offset the increase in at power risk in the Δ CDF and Δ LERF calculations.

As part of the development of the internal events and internal floods PRA model, the major sources of uncertainty for the representative plant were previously identified and characterized (refer to Appendix B of EPRI 1016737). For the Fire PRA model, such an assessment has not yet been performed, but for the purposes of this illustrative example it will be assumed that the major sources of uncertainty include all of those identified for the internal events model plus the fire scenario frequencies and the associated impact vectors (i.e. failed components may be conservatively treated for some scenarios). It is also noted that in many cases the impact of the fire scenarios on SSCs has been conservatively assessed. The quantitative impact for this assessment will include an explicit treatment from these two portions of the PRA model.

A.3.2.2 Level of Detail

To support an application, a PRA model has to have sufficient level of detail to model the cause-effect relationship associated with the LAR. Since this PRA is a detailed PRA, and, in particular, models the RHR loops in detail, it has the level of detail necessary to support this application.

A.3.3 Using the PRA Model

(This section is developed per the guidance in Section 7.2.3.)

This section describes how the internal events and internal floods PRA model and the fire PRA model were used to support the application. The proposed technical specification change involves simultaneous unavailability of several RHR and RHRSW components. The revised CDF and LERF values for the AOT configurations are obtained by re-quantifying the base PRA model with all of the identified events set to TRUE compared to their base-case probability values.

The evaluation of Δ CDF and ICCDP (or Δ LERF and ICLERP) for the AOT change for a plant that has a fuel cycle length of T_{CYCLE} is determined as shown below.

The new annual average CDF due to the change in the AOT, CDF_{NEW} , is given by the following equation:

**Table A-4
INITIAL RISK ASSESSMENT INPUT VALUES**

Input Parameter	Internal Events and Internal Floods	Internal Fires ⁽²⁾	Total
LERF _B	8.18E-08/yr	N/A	N/A
T _A	7 Days	7 Days	7 Days
T _B	7 Days	7 Days	7 Days
T _{CYCLE}	700 Days	700 Days	700 Days
AOT _{NEW}	7 Days	7 Days	7 Days

⁽¹⁾ For simplicity and since it does not significantly impact the results, CDF_{base'} is assumed to be equal to CDF_{BASE} for this assessment.

⁽²⁾ Note that only fire CDF is available and as such a qualitative evaluation will need to be provided for fire LERF.

**Table A-5
INITIAL RISK ASSESSMENT OUTPUT VALUES**

Output Parameter	Internal Events and Internal Floods	Internal Fires	Total
CDF _{NEW}	3.86E-06/yr	1.35E-05/yr	1.73E-05/yr
ΔCDF	1.26E-07/yr	7.58E-07/yr	8.84E-07/yr
ICCDP _A	1.13E-07	3.76E-07	4.89E-07
ICCDP _B	1.28E-07	1.08E-06	1.21E-06
LERF _{NEW}	6.49E-08/yr	N/A	<1.0E-05/yr ⁽¹⁾
ΔLERF	2.67E-10/yr	N/A	<1.0E-07/yr ⁽¹⁾
ICLERP _A	1.52E-10	N/A	<5.0E-08 ⁽¹⁾
ICLERP _B	3.61E-10	N/A	<5.0E-08 ⁽¹⁾

⁽¹⁾ Due to the nature of the RHR/RHRSW function in mostly providing a long term containment heat removal function, there is a very limited impact on LERF as is indicative from the internal events results. Although not explicitly quantified, a significant increase in the LERF related risk metrics is not expected from the fire analysis either.

From the results in Table A-5, the RHR B case will likely lead to exceeding the acceptance guidelines and as a result the fire PRA model was reviewed and further refinement was performed. The refinement included the removal of demonstrated conservatisms and credit for compensatory measures in reducing the fire risk for the analyzed configurations. This

A.3.4 Seismic Risk Implications

This section provides information regarding a bounding assessment of the seismic risk implications of having an RHR Loop out of service for the representative plant. In this example, the hypothetical plant does not have a full seismic PRA. In order to evaluate the potential seismic risk implications, a focused, bounding seismic risk assessment is provided to evaluate the role of the RHR loops in mitigating seismic-induced events³.

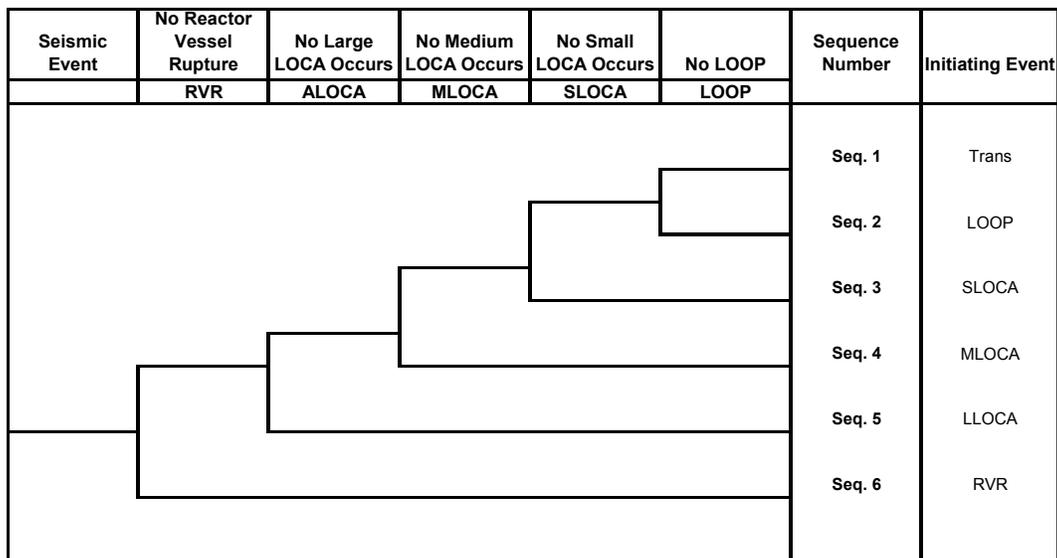
A.3.4.1 Methodology

A simplified seismic initiator event tree is provided to partition the effects of a seismic event into the following initiator categories:

- Reactor Vessel Rupture (RVR)
- Large LOCA
- Medium LOCA
- Small LOCA
- Loss of Offsite Power (LOOP)
- Transients

The basic approach and structure for the partitioning of seismically-induced initiating events from the seismic PRA described in NUREG/CR-4550, Volume 4, Part 3 is used [Ref. A.4]. The event tree structure is shown below in Figure A-1.

Figure A-1 Simplified Seismic Initiator Event Tree



Consistent with Ref. A.4, a LOOP condition is assumed to exist for all sequences except Sequence 1. The latest NRC data on seismic hazards, NUREG-1488 [Ref. A.5] is used to

³ The ability to assess seismic contributors to an application is specific to the plant and change being evaluated. This example is not to be construed as providing generic dispositions of the seismic risks.

In the internal events PRA, the loss of condenser initiators during the removal of the RHR loop from service contributed only about 5% to the change in risk. Thus, it is concluded that the risk contribution from seismically-induced transients is negligible.⁴

LOOP Events

In the internal events PRA, LOOP events are relatively important contributors to the risk associated with the RHR loop out of service condition. This is due to the loss of condenser condition caused by the loss of offsite power. Given a loss of condenser event, the RHR system and the containment vent are the only two means of containment heat removal available. For the plant being evaluated, the containment vent capability has been seismically evaluated and found to have a significantly higher seismic capacity than the RHR loops. This means that the vent would be expected to be available to mitigate the seismic LOOP condition. Therefore, it can be assumed that seismic-induced LOOP events present a challenge similar to a traditional LOOP, except offsite power recovery is assumed to be precluded, i.e., unrecoverable in the timeframe considered by the PRA.

The risk implications of seismically-induced LOOPS is assessed by comparing the frequency of seismic-induced LOOP events to the frequency of unrecovered LOOP events that are due to other causes (i.e., grid, plant centered, and weather), as treated in the internal events PRA.

The internal events PRA utilizes LOOP occurrence and recovery data from NUREG/CR-6890 [Ref. A.7]. Based on this data, the site-specific frequency of long term losses of offsite power (i.e., those >24 hours in duration) is approximately 5E-4/yr. This compares to the frequency of seismically-induced LOOP events from Table A-9 of 1.06E-4/yr. So, the seismically-induced LOOP events are roughly 20% of the internal events frequency.

Additionally, LOOP events contribute roughly 20% of the total delta risk from internal events (refer to Section A.3.1.2). Conservatively assuming that **all** LOOP contribution to the delta risk comes from long-term losses of offsite power means that the seismically-induced events might increase the delta risk by approximately 4% (20% of 20%).

Based on the internal events results above for Δ CDF, ICCDP_A, and ICCDP_B, a 4% increase to each of those figures of merit can be approximated as shown below. These bounding values are all less than within 1% of the corresponding acceptance guidelines. Given the bounding nature of this assessment, this is judged to be insignificant.⁵

Output Parameter	Internal Events	Bounding Seismic LOOP Estimate (4%)
Δ CDF	6.30E-08/yr	6.30E-08/yr * 0.04 = 2.5E-09/yr
ICCDP _A	5.37E-08	5.37E-08 * 0.04 = 2.1E-09
ICCDP _B	6.71E-08	6.71E-08 * 0.04 = 2.7E-09

⁴ The conclusions related to the relevance of seismic-induced transient events to the application are specific to the plant and change being evaluated and are not be construed as generic dispositions of the contributor.

⁵ The conclusions related to the relevance of seismic-induced LOOP events to the application are specific to the plant and change being evaluated and are not be construed as generic dispositions of the contributor.

LOCA Events

RHR loops support more than one function in the mitigation of LOCA events, i.e., both containment heat removal and RPV makeup. The risk from seismically-induced LOCAs will be bounded by evaluating the change in overall RHR reliability that occurs when one loop is out of service and using that as an indicator of the change in LOCA risk.

Based on the RHR model from the representative site PRA, the overall reliability of RHR with both loops available assuming an unrecoverable loss of offsite power scenarios is $7.1E-04$ and is $8.4E-03$ with one loop out of service. Thus, the overall reliability of RHR changes by approximately a factor of 10 (due to the redundant nature of the design of the system and supporting emergency diesel generators). By assuming that the RHR reliability will have a direct impact on *all* LOCA risk (i.e. the remaining loop of RHR during the AOT would not be impacted by the seismic event and would be required to mitigate all LOCA events), the change in seismic risk can be conservatively approximated. (In a typical PRA, seismic failures of RHR would be correlated so that both loops would be failed. Therefore, there would be no impact on the seismic risk of a loop being out of service.)

From Table A-9, it can be seen that the frequency of seismically-induced Small, Medium and Large LOCAs is $8.55E-6/yr$ (i.e., $5.20E-06/yr + 6.46E-07/yr + 2.70E-06/yr$). Assuming that the change in risk can be reflected by the remaining RHR loop reliability, the risk change is bounded as $8.55E-6/yr * 8.4E-03 = 7.2E-8/yr$. Over a 7 day AOT, this contributes only approximately $1.4E-9$ to the ICDP ($7.2E-8/yr * 7 \text{ days} / 365 \text{ days/yr}$), or roughly 0.3% of the acceptance guidelines. Given the bounding nature of this assessment, this is judged to be insignificant.⁶

Reactor Vessel Rupture

Reactor vessel rupture (RVR) events cannot be mitigated. Thus, the unavailability of an RHR loop has no impact on the risk associated with seismically-induced RVR events.

Conclusion

Bounding analyses were performed to consider the potential seismic contribution for the RHR/SPC loop out of service during the AOT configuration. This included an evaluation of six separate initiating event consequences from the gamut of potential seismic events. One of the categories was determined to be un-impacted by the RHR/SPC loop out of service configuration (reactor vessel rupture), and the other five initiating event categories were determined to have no more than a few percent impact compared to the acceptance guidelines. Given the results of these bounding assessments, they are not carried further in the analysis.⁷

⁶ The conclusions related to the relevance of seismic-induced LOCA events to the application are specific to the plant and the change being evaluated and are not be construed as generic dispositions of the contributor.

⁷ The relevance of the seismic risk contribution to the application and to the decision being considered are specific to the plant and the change being evaluated. This example is not be construed as a generic disposition of the contributor.

Table A-18
SIGNIFICANT CONTRIBUTORS TO THE INTERNAL EVENTS AND INTERNAL FLOODS
EVALUATION (RHR "B" LOOP CASE)

Event Name	Probability	Fussell-Vesely	Risk Achievement Worth	Description
BHU8ABDXI	6.90E-03	5.96E-02	9.58	FAILURE TO RESTART RUNNING PUMP OR START STANDBY PUMP
ECB505DNI	2.57E-04	4.62E-02	180.85	D114 BUS XFRMR BREAKER 152-11505 FAILS TO RE-CLOSE
ZHULVCDXI	5.60E-04	4.46E-02	80.51	OP FAILS TO CNTRL LVL IN A TRANS WITH LP INJECTION
AHUBCIDXI	1.80E-02	3.71E-02	3.02	OPERATOR FAILS TO BYPASS DIV 1 AND II CONTAINMENT ISOL.
EHUTIEDXI	6.70E-03	3.41E-02	6.05	OPERATOR ACTION TO CROSSTIE TO 4KV BUSES FAILS
ZHUCSTDIXI	1.85E-03	3.41E-02	19.4	JOINT HEP FOR REFILLING CST VIA ANY MEANS
NODG2E	8.20E-01	3.21E-02	1.01	FAILURE TO RECOVER EDG IN 2.5 HRS / NO RECOVERY IN 0.5 HRS
NODGE	1.00E+00	3.21E-02	1	FAILURE TO RECOVER DIESEL EARLY (30 MINUTES)
BPMAFACTOR	5.00E-01	3.11E-02	1.03	FRACTION OF RUNNING TIME FOR CRD PUMP 1AP158

Table A-19
INTERNAL EVENTS AND INTERNAL FLOODS CONTRIBUTORS THAT ARE
POTENTIAL SOURCES OF UNCERTAINTY⁸

Contributor	Reason for Importance
Viability of CRD injection post containment failure	CRD is one of the only systems available for RPV makeup following containment failure. While the flow path for CRD to the RPV traverses through the Reactor Building, it is sufficiently low in the structure and protected that only certain containment failure modes and locations would impact it.
Various Human Errors: <ul style="list-style-type: none"> - Failure to depressurize RPV - Failure to bypass containment isolation - Failure to cross-tie IA to PCIG - Failure to utilize CRD for RPV Makeup 	The human actions are important to avoiding the long-term loss of containment heat removal condition or providing RPV makeup after containment challenge that eventually lead to core damage.

⁸ The specific sources of model uncertainty relevant to the decision are specific to the plant and change being evaluated. This table is not be construed as providing generic dispositions of the potential sources of uncertainty.

**Table A-26
UNIQUE INTERNAL FIRE CONTRIBUTORS THAT ARE
POTENTIAL SOURCES OF UNCERTAINTY⁹**

Contributor	Reason for Importance
Scenario initiating event frequencies	Recent fire PRAs performed for NFPA-805 have identified that the fire ignition frequencies derived from EPRI TR-1011989 have a conservative bias. Recent EPRI work has found that improvements in industry performance over the past 20 years have reduced fire ignition frequencies by roughly a factor of two.
General conservatism of fire scenario treatment	The fire PRA performed for this plant contains a general conservative bias in the definition of the fire damage scenarios and human actions. This bias tends to overstate the fire CDF contributions. If the analysis identified that the RHR Loop condition was excessive, then these conservative biases could be eliminated, but since the results appear to support the AOT extension, they are tolerated in this analysis.

The modeling of fire effects is generally considered to be a source of model uncertainty. However, in this hypothetical case, the scenarios contributing to the increased fire risk due to the RHR Loops being out of service did not rely on fire modeling. Bounding assumptions were made regarding fire impacts. This is one of the reasons for characterizing the fire PRA results as generally conservative for this evaluation.¹⁰

A.4.2 Assessment of Uncertainty

As discussed in Chapter 3, epistemic uncertainty is generally categorized into three types — parameter, model, and completeness uncertainty. Because they are characterized in different ways, the approaches to addressing them are different as discussed below. The analysis of uncertainty is best carried out sequentially, dealing first with parameter uncertainty, and then addressing model uncertainty. This needs to be done both for the hazard groups separately and in combination.

⁹ The specific sources of model uncertainty related to fire contributors that are relevant to the decision are specific to the plant and change being evaluated. This table is not be construed as providing generic dispositions of the potential sources of uncertainty.

¹⁰ The specific sources of model uncertainty related to fire modeling are specific to the plant and change being evaluated. In other cases, where detailed fire modeling is relied upon, this would be likely to be considered a source of model uncertainty. This statement is not be construed as providing generic dispositions of the fire modeling as a source of model uncertainty.

A.4.2.1 Parameter Uncertainty

(This section is developed per the guidance in Section 7.3.3.1.)

The cutset results for the four different delta-CDF assessments were reviewed to determine if the epistemic correlation could influence the mean value determination. From the review of the cutsets, it was determined that the dominant contributor cutsets do not involve basic events with epistemic correlations (i.e. the probabilities of multiple basic events within the same cutset for the dominant contributors are not determined from a common parameter value). Per Guideline 2b from EPRI 1016737, then it is acceptable to use the point estimate directly in the risk assessment.

To verify that the use of the point estimate is acceptable in these four cases, a detailed Monte Carlo calculation was performed to compare the mean value determined from the Monte Carlo simulation as compared to the point estimate. The results of those assessments are provided in Table A-27 below. Figures displaying the probability density function for each of the cases appear after the table. Based on the minimal difference in the comparison of the mean value with the point estimate values provided, the use of the point estimate for this assessment is deemed acceptable.¹¹

**Table A-27
PARAMETRIC UNCERTAINTY EVALUATIONS AND
COMPARISON TO POINT ESTIMATE RESULTS**

Result	Internal Events and Internal Floods		Internal Fires	
	RHR "A" Case	RHR "B" Case	RHR "A" Case	RHR "B" Case
Propagated Mean Values⁽¹⁾				
$CDF_X^{(1)}$	6.56E-06/yr	7.31E-06/yr	1.57E-05/yr	3.05E-05/yr
$CDF_{BASE}^{(1)}$	3.80E-06/yr		1.25E-05/yr	
$\Delta CDF^{(1)} = CDF_X - CDF_{BASE}$	2.76E-06/yr	3.51E-06/yr	3.20E-06/yr	1.80E-05/yr
Point Estimate Mean Values⁽²⁾				
$CDF_X^{(2)}$	6.53E-06/yr	7.23E-06/yr	1.57E-05/yr	3.03E-05/yr
$CDF_{BASE}^{(2)}$	3.73E-06/yr		1.25E-05/yr	
$\Delta CDF^{(2)} = CDF_X - CDF_{BASE}$	2.80E-06/yr	3.50E-06/yr	3.20E-06/yr	1.78E-05/yr

⁽¹⁾ Developed based on the parametric mean value for each case from a Monte Carlo simulation with 10,000 samples.

⁽²⁾ Developed based on the point estimate value for each case.

¹¹ For this case, the epistemic correlation had little influence on the mean results. This may not be the case in all instances.

**Table A-28
IDENTIFICATION OF POTENTIAL KEY SOURCES UNCERTAINTY¹²**

Source of Uncertainty	Base Model	Application Important Contributor	Source of Model Uncertainty Assessment	Potential Key Source of Uncertainty
HEPs for utilizing CRD injection	Yes	Yes	There are three CRD-related HEPs that influence both the internal events and internal fire events evaluations (BHU8ABDXI, BHUMX2DXI, and ZHUCSTDIXI). The credited actions are procedurally directed with the calculated HEP values derived from an accepted methodology. Although variations to the HEP values may lead to changes in the risk assessment results, only very bounding assumptions regarding the appropriate HEP values for these individual actions would lead to exceeding the risk metric acceptance guidelines. In any event, the HEPs for utilizing CRD injection are identified as a potential key source of uncertainty for this application as part of the HEP development as a global source of uncertainty.	Yes – included as part of HEP development as a class
HEP values for operator fails to depressurize	Yes	Yes	The credited actions (AHUXTRDXI and ZHUAAXDXI) influence both the internal events and internal fire events results. They are procedurally directed with the calculated HEP values derived from an accepted methodology. Although variations to the HEP values may lead to slight changes in the risk assessment results, only very bounding assumptions regarding the appropriate individual HEP values for these actions would lead to exceeding the risk metric acceptance guidelines. In any event, the HEPs for depressurizing the RPV are identified as a potential key source of uncertainty for this application as part of the HEP development as a global source of uncertainty.	Yes – included as part of HEP development as a class

¹² The identification and disposition of the potential sources of uncertainty are specific to this plant, this model, and this application and are not to be considered generic dispositions.

an evaluation of the maximum Risk Achievement Worth approach as is described in Section 5.4 to screen certain items, but for the remaining items realistic sensitivity cases are performed. Based on the analysis of the results of this assessment with one loop of RHR known to be unavailable, there were no identified logical combination sensitivity cases to explore. Additionally, two sources of model uncertainty (i.e. assumptions related to viability of non-CRD systems following containment venting or containment failure, and the Fire PRA model assumption that all scenarios with credit for FW/PCS always require bypass of the containment isolation signal and cross-tie of instrument air to instrument gas to maintain air supply to inboard MSIVs) are not explored with sensitivity studies since they are most likely to reduce the relevant risk measures and therefore could only improve the margin compared to the acceptance guidelines.

Table A-29 is a sample presentation format for the sensitivity case results for this hypothetical LAR example with acceptance guidelines of 1.E-6/yr for Δ CDF and 5.0E-7 for ICCDP, respectively. Note that the results of each sensitivity case are presented for the total risk metrics (i.e. the combined impact from the internal events and internal fire events assessments), and for ICCDP for the cases with either loop A or loop B unavailable. Insights regarding potential compensatory measures that would reduce the risk metrics associated with the source of uncertainty are also identified.

**Table A-29
PRESENTATION OF SENSITIVITY STUDY RESULTS¹³**

	Total ΔCDF	Total ICCDP	Above ΔCDF Limit?	Above ICCDP Limit?	Potential Compensatory Measures
Base Case Assessment (R_o Values)	2.7E-7	A: 1.2E-7 B: 4.1E-7	No	No No	Base case compensatory measures include no maintenance on selected components. This compensatory measure will be enforced during the RHR/SPC AOT.
Source of Uncertainty and Individual Sensitivity Study Results (R_s Values)					

¹³ The specific sensitivity studies presented here are only applicable to this example. In some cases, where the impact can be shown to be minimal, a conservative screening study is performed. In other cases, a more measured approach is taken based on reasonable alternatives derived from an understanding of the bases for the base case analysis.

**Table A-29
PRESENTATION OF SENSITIVITY STUDY RESULTS¹³**

	Total ΔCDF	Total ICCDP	Above ΔCDF Limit?	Above ICCDP Limit?	Potential Measures	Compensatory
1. Human Error Probability (HEP) development (Note 1)	1.0E-6	A: 7.1E-7 B: 1.2E-6	Yes	Yes Yes	Perform pre-shift briefs on potentially important actions: <ul style="list-style-type: none"> • Maximize CRD flow for RPV injection • Depressurize RPV for low pressure injection • Bypass containment isolation for PCIG • Cross-tie IA to PCIG to maintain inboard MSIVs open for use of FW/PCS 	
<p><i>Note 1: In this example application, all HEP events are set to their 95th percentile values. This resulted in HEPs that were multiplied by factors in the range of 2 to 4. While this range is smaller than that which could be obtained by using a totally different HRA approach, it is sufficient, in this case, to demonstrate that the HEP values are a potentially key source of uncertainty. Further, the HRA was performed using a systematic approach that is consistent with the ASME PRA standard and has been peer reviewed. One of the requirements of the standard is that the HEPs be compared as a set to ensure that the ranking is appropriate to the context within which HEP is evaluated. The identification of significant contributors discussed in Section A.4.1.2 resulted in the identification of the most significant human failure events, and these are the ones identified for potential compensatory measures above.</i></p>						
2. Total frequency of medium LOCAs that are too big for CRD makeup capabilities (Note 2)	3.0E-7	A: 1.4E-7 B: 4.3E-7	No	No No	N/A – Bounding sensitivity case still leads to results within the acceptance guidelines.	
<p><i>Note 2: Current MLOCA frequency of 3.9E-4/yr is greater than alternative hypothesis of 1.1E-4/yr from NUREG/CR-6928. Therefore, sensitivity case provides a conservative screening assessment by setting all of the current MLOCA frequency to be greater than CRD makeup capability.</i></p>						

Based on these results, the following two items are identified as **key** sources of uncertainty for this application¹⁴:

- Human Error Probability (HEP) development as a class
- The basis for determining CRD survivability following containment failure scenarios

Following the guidance in Section 5, it is incumbent upon the analyst to characterize the degree of confidence in the assumptions associated with the sources of uncertainty listed above that lead to the base case results (with compensatory measures incorporated) being within the acceptance guidelines. It is not the intent of this process to say that the results of any one or more sensitivity case being above the acceptance guidelines should automatically lead to a negative outcome by the decision maker. On the contrary, the intent of the process is to clearly identify those sources of uncertainty that are key to the decision (and therefore by definition will challenge the acceptance guidelines), and that appropriate compensatory measures have been identified to implement or otherwise deal with the key sources of uncertainty.

Additionally, it should be noted that one of the main points of the HEP development sensitivity as a class is to confirm that a systematic bias in the HRA process is not suppressing an important insight. The purpose of setting all of the HEPs to the 95th percentile value at the same time is to see if some additional actions should be separately identified as important. An examination of the important contributors from sensitivity case did not identify any new insights or indicate that there any more compensatory measures that might want to be considered.

A.4.2.3 Completeness Uncertainty

(This section is developed per the guidance in Section 7.3.3.3.)

Table A-3 in Section A.2.2.2 presents a summary of the disposition of those hazard groups not included in the PRA. As discussed there, the majority of those hazard groups were screened based on qualitative or quantitative considerations. The seismic hazard group was demonstrated to be an insignificant contributor based on a simple, but conservative model as discussed above.¹⁵

A.5 Summary of Results of the Risk Assessment

Table A-30 shows a comparison of the individual hazard group core damage risk metrics to the acceptance guidelines. As stated previously, the focus is on the core damage risk metrics since the large early risk metrics were determined not to be significant contributors for this hypothetical LAR. The base case results with compensatory measures in place to avoid maintenance on selected components and trains show that the threshold acceptance values are met for Δ CDF and ICCDP when the A RHR loop is out of service and when the RHR B loop is out of service for the extended AOT.

The results of a structured process for identifying potential key sources of uncertainty led to the performance of four sensitivity studies. The sensitivity studies were performed to identify the key sources of uncertainty and related assumptions for this PRA application. The results and

¹⁴ The specific key uncertainties identified here are only applicable to this example and are not to be construed as generically applicable.

¹⁵ This conclusion applies only for this application for this plant and is not to be construed as generically applicable.

Future Work

- Staff's plans on Appendix A:
 - Early April -- make Appendix A publicly available for May 5,6 workshop (with the current changes and any additional ones from today's meeting)
 - July/August -- based on workshop, make any additional needed changes and formally publish Appendix A (Volume 2 to NUREG-1855)
- Based on insights from workshop and user needs, identify future work; for example:
 - Short and long term needs
 - Additional examples
 - Expanded scope with regard to guidance (e.g., internal fire, new reactors)
- Will continue to interact with ACRS