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 Open Session

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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RELIABILITY AND PRA SUBCOMMITTEE

+ + + + +

OPEN SESSION

+ + + + +

WEDNESDAY

MAY 2, 2018

+ + + + +

ROCKVILLE, MARYLAND

+ + + + +

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

COMMITTEE MEMBERS:

JOHN W. STETKAR, Chairman

RONALD G. BALLINGER, Member

DENNIS C. BLEY, Member

MICHAEL CORRADINI, Member

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VESNA B. DIMITRIJEVIC, Member

WALTER L. KIRCHNER, Member

JOSE MARCH-LEUBA, Member

JOY L. REMPE, Member

GORDON R. SKILLMAN, Member

MATTHEW SUNSERI, Member

DESIGNATED FEDERAL OFFICIAL:

CHRISTIANA LUI

ALSO PRESENT:

MICHAEL CHEOCK, RES

GARILL COLES, PNNL

MARY DROUIN, RES

DAN HUDSON, RES

ALAN KURITZKY, RES

MARVIN LEWIS*

JOHN NAKOSKI, RES

STEVE SHORT, PNNL

NATHAN SIU, RES

JEFF WOOD, RES

*Present via telephone

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

2 (8:30 a.m.)

3 CHAIR STETKAR: The meeting will now come
4 to order. This is a meeting of the Reliability PRA
5 Subcommittee of the Advisory Committee on Reactive
6 Safeguards. I'm John Stetkar, Chairman of the
7 Subcommittee Meeting. ACRS Members in attendance are
8 Ron Ballinger, Dick Skillman, Mike Corradini, Matt
9 Sunseri, Walt Kirchner, and Joy Rempe.

10 We will be joined by Jose March and Vesna
11 Dimitrijevic. I'm sorry Vesna. You're hiding over in
12 the corner. You're not going to hide for long. We
13 will be joined by Jose March-Leuba and Dennis Bley as
14 soon as they get their things in order. Christiana
15 Liu of the ACRS staff is the designated federal
16 official for this meeting.

17 The Subcommittee will hear presentations
18 on the progress of the Level 3 PRA project. The
19 Subcommittee will gather information, analyze relevant
20 issues and facts, and formulate proposed positions and
21 actions as appropriate for deliberation by the full
22 Committee.

23 A portion of this meeting will be closed
24 in order to discuss and protect information that is
25 proprietary pursuant to 5 USC 552(b)(c)(4). The ACRS

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1 was established by statute and is governed by the
2 Federal Advisory Committee Act. This means that the
3 Committee can only speak through its published letter
4 reports. We hold meetings to gather information to
5 support our deliberations.

6 Interested parties who wish to provide
7 comments can contact our office requesting time after
8 the meeting announcement is published in the federal
9 register. That said, we also set aside some time for
10 spur of the moment comments from members of the public
11 attending or listening to our meetings. Written
12 comments are also welcome.

13 The ACRS section of the U.S. NRC public
14 website provides our charter, bylaws, letter reports,
15 and full transcripts of all open, full, and
16 Subcommittee meetings, including slides presented at
17 these meetings.

18 The rules for participation in today's
19 meeting were previously announced in the federal
20 register. We've received no written comments or
21 requests for time to make oral statements from members
22 of the public regarding today's meeting.

23 We have a bridgeline established for
24 interested members of the public to listen in during
25 the open session. To preclude interruption of the

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1 meeting, the phone bridgeline will be placed in a
2 listen-in mode during the presentations and Committee
3 discussions. We'll unmute the bridgeline at a
4 designated time to afford the public an opportunity to
5 make a statement, or provide comments.

6 Note that there is renovation being done
7 on the floor above the meeting room. So there might
8 be unavoidable construction noises from time to time.

9 It says, might be, there will be. Just speak up.
10 Use your adult voices, and we'll try to rise above
11 that.

12 A transcript of the meeting is being kept
13 and will be made available as stated in the federal
14 register notice. Therefore, we request that
15 participants in this meeting use the microphones
16 located throughout the meeting room when addressing
17 the Subcommittee. The speaker should first identify
18 themselves, and speak with sufficient clarity and
19 volume so that they may be readily heard.

20 For those of you up front make sure that
21 the green light on the microphone is on. You know how
22 to do that? There's a little thing on the bottom that
23 says, PUSH. And please turn it off when it's not in
24 use, because the rustling of the papers gets picked up
25 and makes it difficult for the transcript.

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1 Also anybody in the room, please turn off
2 your cell phones and any other kind of little
3 electronic beepy devices that you may have, so we're
4 not interrupted with those.

5 And I will now proceed with the meeting.
6 And I call upon Mike Cheock, for any introductory
7 remarks you'd like to make, Mike.

8 MR. CHEOCK: Just a quick one. I thank
9 the Subcommittee again for your interest in this
10 project. And I would like to especially thank, Mr.
11 Stetkar and Dr. Powers, who's not here today. But for
12 their long running support of the project and we look
13 forward to your comments. And we will continue to
14 address the comments, as we get them. Thank you.

15 CHAIR STETKAR: Alan it's all yours.

16 MR. KURITZKY: Thank you, Chairman
17 Stetkar. My name is Alan Kuritzky. I'm with the
18 Division of Risk Analysis in the Office of Research.
19 And I would just initially like to echo Mike's
20 sentiments. I greatly appreciate the continued
21 interest of the Subcommittee and the valuable feedback
22 we've received.

23 And this I think is our 13th appearance
24 before this Subcommittee. And all throughout the
25 project, going back six or more years, and the

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1 feedback we've had has greatly helped to improve the
2 quality of the models and documentation. So we very
3 much appreciate that.

4 Also up here with me today is Jeff Wood
5 from the Division of Risk Analysis, and contractors
6 from the Pacific Northwest National Lab, Garill Coles
7 and Steve Short. You'll be hearing from them a little
8 bit later on the PIRT NUREG. And then we have several
9 other individuals that will be coming up to present to
10 you in the closed session.

11 So just quickly to go over what we're
12 going to talk about today. In the open session,
13 you'll get my quick overview of the status of the
14 project. And then as I mentioned, you'll hear from
15 PNNL regarding the low power shutdown, phenomena
16 identification and ranking table, expert elicitation
17 that we performed for low power, you know, shutdown
18 PRA, and that we've turned into a NUREG/CR.

19 When we go to the closed session, the
20 primary topic will be the Level 2 PRA. Specifically,
21 that associated with external fires, and external
22 hazards, and then also for shutdown. Lastly, right
23 before the end of the closed session, I'm going to
24 speak a few minutes with the Subcommittee to talk
25 about future interactions, both with the Subcommittee,

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1 and with the full Committee.

2 And also at the beginning of the closed
3 session, we're going to hear just a few minutes from
4 some representatives from Southern Nuclear
5 Corporation. We're going to talk about their
6 perspectives on the project.

7 Okay, so moving onto the status overview,
8 this is a slide that you've seen many times before in
9 previous presentations. This is not all the specific
10 models that we're doing. There's more than this. But
11 this set of bullets on this slide are there to,
12 they're organized in the same manner that you're going
13 to hear about this national project and the subsequent
14 viewgraphs.

15 So we'll start off with looking at the
16 reactor models. Moving onto spent fuel pool, dry cask
17 storage, integrated site risk. And lastly, we'll talk
18 about some upcoming project milestones.

19 This is also a view you've seen several
20 times before. And the only difference between this
21 and the previous versions you've seen, is I added the
22 Phase 1, Phase 2 blocks up at the top. And it's
23 really one of the main things that viewgraph is trying
24 to get at. Because this is going to help when we
25 discuss the status in the subsequent viewgraphs.

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1 Because I'll talk about Phase 1 and Phase 2 models and
2 reports.

3 Phase I essentially is the development of
4 the initial model and documentation. That's the
5 lion's share of the work. It goes through several
6 rounds of internal review before moving to our
7 external review in the middle there. And then that
8 external review involves review by our technical
9 advisory group.

10 It also had previously involved PWR Owners
11 Group led, peer reviews to the PRA standards.
12 Unfortunately, because of budget issues, that's no
13 longer going to go on. You know, going forward, we'll
14 no longer be able to avail ourselves of those --

15 CHAIR STETKAR: Alan.

16 MR. KURITZKY: Yes.

17 CHAIR STETKAR: Just because I can't
18 remember anything these days, what elements of the
19 models of the risk assessment did you benefit from the
20 PWR Owners Group review?

21 MR. KURITZKY: So, for the PWR Owners
22 Group review, we had the Level 1 for internal events,
23 Level 1 internal events, Level 1 internal floods,
24 Level 2 -- for internal events, internal floods, we
25 had Level 1, 2, and 3. All three of those.

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1 CHAIR STETKAR: All three? All three,
2 okay.

3 MR. KURITZKY: Level 2 and 3, we're using
4 a trial use standards. And then we also had the other
5 hazard, the high wind and other hazards was also
6 subject to the standards-based peer review. And the
7 last thing we got from the PWR Owners Group was a work
8 shop on identifying review criteria for dry cask
9 storage. There is no standard, but they had a kind of
10 like an expert meeting to come up with review
11 criteria.

12 CHAIR STETKAR: But they did not look at
13 the --

14 MR. KURITZKY: The dry cask?

15 CHAIR STETKAR: -- internal fires, or
16 seismic --

17 MR. KURITZKY: No, no, fires, seismic
18 unfortunately they're not --

19 CHAIR STETKAR: Okay.

20 MR. KURITZKY: -- that's going to rely
21 more heavily on the TAGs.

22 MEMBER REMPE: So, in a prior meeting I
23 thought we'd asked to see a copy of their review
24 comments. Did we get that?

25 MR. KURITZKY: I don't think so, which

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1 particular review?

2 MEMBER REMPE: It was the one last
3 November, because I actually kind of looked back at
4 our --

5 MR. KURITZKY: I know November, but which
6 model, I mean which --

7 MEMBER REMPE: Well, we'd asked to see the
8 PWR Owners Group review comments.

9 MR. KURITZKY: For which model?

10 MEMBER REMPE: For the Level 2 evaluations
11 is what I was interested in --

12 MR. KURITZKY: Okay, okay.

13 MEMBER REMPE: -- but I think we asked in
14 general. And I don't recall, did you get anything
15 from the PWR review?

16 MR. KURITZKY: No, I don't think we have.

17 CHAIR STETKAR: No, we haven't. They
18 haven't.

19 MEMBER REMPE: So are we going to get
20 that?

21 MR. KURITZKY: Yes, yes, I'm sorry I must
22 have just not seen that when I took, transcribed the
23 notes. So you want the PWR Owners Group --

24 MEMBER REMPE: I'm just, yes, I'm
25 interested in their comments and they had. And

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1 actually the spent fuel, what they gave you. I think
2 these --

3 CHAIR STETKAR: Alan, if you're taking
4 notes, just whatever you have from them that's
5 packaged.

6 MR. KURITZKY: Right. The only thing to
7 keep in mind, is that is appropriate that PWR Owners
8 Group work is proprietary to Westinghouse, PWR Owners
9 Group is proprietary information. So I'll have to --

10 MEMBER REMPE: Well, the whole Vogtle
11 stuff. And a lot of this is --

12 CHAIR STETKAR: Yes.

13 MR. KURITZKY: Right, right. That's a
14 different level of proprietary. But I'll, we'll just
15 have to confirm with Westinghouse and the PWR Owners
16 Group, and then we'll be able to -- so this is
17 comments on Level 2. Okay, I'll make sure that we
18 look at that.

19 MEMBER REMPE: Thank you.

20 MR. KURITZKY: Okay, so that's the
21 breakpoint between Phase 1 and Phase 2. Once we get
22 all that feedback, we then go and update the models
23 and documentation. That's Phase 2. And once that
24 goes through its final internal reviews and signed
25 out, that's the end of that piece of the study.

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1 So just to keep that in mind, Phase 1 is
2 prior to the TAG and or standards reviews. And Phase
3 is afterwards.

4 So here's where the project status stands.

5 If you compare this to the figure that we showed you
6 in October, hopefully you'll see that some of the blue
7 bars have moved further to the right.

8 Primarily in the "at-power, all hazards",
9 it's been substantial progress. The "reactor,
10 at-power, internal events and floods" is getting very
11 close to being done. And again, these bars are a wrap
12 up of everything. The model, the initial and final
13 models, documentation, all the review cycles and
14 input. And they also have a weighted average of the
15 Level 1, 2, and 3 PRA. So, it's all put into one bar,
16 just to make it all fit on the page.

17 So when you see, generally like for
18 instance the all, "the reactor, at-power, all
19 hazards", or "low power shutdown, internal events",
20 "spent fuel pool", the white at the end is primarily
21 the Level 3. Because that's the part that we haven't
22 really moved forward on in most places.

23 Level 1 and 2 depending on which topic it
24 is, we've made fairly substantial progress. Mostly
25 it's the Level 3, except for again, as I said,

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1 "reactor, at-power, internal events and floods". And
2 also the "dry cask storage". Those both have already
3 had the initial Level 3 worked on.

4 The "dry cask storage", "integrated site"
5 if you compare to the previous diagram, they haven't
6 moved at all. Unfortunately, they've been kind of
7 mostly in a period of stasis. But there's been some,
8 the traffic jam is starting to break free just
9 recently. So we're hoping for some continued progress
10 there.

11 Overall, I would say the project is about
12 three quarters of the way done. So that's pretty much
13 where we stand now.

14 Okay, so looking at the internal events
15 and floods, as we just mentioned, we have completed
16 the peer reviews, the standards-based peer reviews for
17 all three of those, Level 1, 2, and 3 for internal
18 events and floods.

19 We've completed the substantive updates
20 for all those models, so essentially the Phase 2
21 models and reports are complete. The Level 1,
22 internal events and the Level 2, internal event,
23 flood, have totally been signed off now.

24 The internal flood Level 1 is just about
25 complete. There's just a few final project management

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1 comments that have to be cleaned up, and then that
2 will be signed out in the very near future.

3 The Level 3 is in its Phase 2, and that
4 part is mostly complete. The only thing that we're
5 still working on, the risk characterization where we
6 combined the consequence analysis with the release
7 category frequency information, to come up with the
8 risk matrix.

9 So we're working to complete that task.
10 And then we'll have to go through the final internal
11 and project management reviews. So, getting close for
12 completing all that work.

13 Also I just wanted to mention, we
14 previously have discussed it with the Subcommittee,
15 expert elicitation for IS LOCA, we're just pointing
16 out that was another thing that was accomplished under
17 this category.

18 Moving on to internal fires and seismic
19 events. Here just to remind Subcommittee Members, or
20 anybody who's new who wasn't involved previously, so
21 we originally got information from the utility on the
22 fire and seismic PRAs. Ours are largely based on
23 their models or their information.

24 However, once we completed our initial
25 models and reports the utility was able to provide us

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1 a lot of updated information. And so much so that we
2 had to go back and redo those models and reports,
3 essentially from the beginning. So that kind of put
4 us back a little bit. But made for much more complete
5 and accurate models.

6 We've now completed those updates.
7 They've gone through internal technical review. And
8 now they're sitting in the project management step for
9 the fire. We're actually actively doing that project
10 management review, and we're getting close to wrapping
11 that up.

12 The seismic one is still sitting in the
13 queue waiting for someone to grab it. No one has been
14 reaching any hands into the cookie jar yet, but I may
15 grab that shortly. So, in any case that one is a
16 little bit further behind than the fire.

17 But again, the main change that's occurred
18 since the last meeting in October is really with the
19 Level 2 modeling. For both seismic and fire events we
20 completed those models. You're of course going to
21 hear more about that in the closed session. But we
22 have those models complete.

23 We've provided that information, the
24 models and information to the consequence analysis
25 team. So they can begin work on the Level 3 aspects.

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1 And in the meantime we're working just to finalize a
2 little bit of the documentation.

3 The two main thing that still have to be
4 done, from the Level 2 perspective is the propagation
5 of parameter uncertainties. And then also need to
6 complete the self-assessment. But again you'll hear a
7 lot more in the closed session.

8 Moving on to the high winds and other
9 hazards. This again as we mentioned just previously,
10 they've already been through their standards-based
11 peer reviews. The big accomplishment since last
12 October was we did finally sign off the Phase 2 report
13 for the high winds. So that one is done.

14 The other hazards that one, the Phase 2
15 report is in for project management review. It's been
16 that way for many, many months, long before the
17 October meeting. Again, due to staffing issues, we
18 finally do have the project management reviewer back
19 on line. And so that review just re-engaged, I think
20 last week. And so we hope to get that completed very
21 soon.

22 CHAIR STETKAR: Alan, you haven't done
23 anything on Level 2 for high winds yet, have you?

24 MR. KURITZKY: No, so yes, I'm sorry. I
25 should have mentioned that before. When I was doing

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1 the organization for today's -- it said seismic fire
2 and high winds. Seismic fire, you're going to hear
3 about. The high winds we haven't quite got there yet,
4 yes. The idea being that we were limited --

5 CHAIR STETKAR: I just wanted to make
6 sure, you know, we kind of get snap shots --

7 MR. KURITZKY: No, I know, right.

8 CHAIR STETKAR: -- of things that are sort
9 of early, you know --

10 MR. KURITZKY: Right.

11 CHAIR STETKAR: -- January through March
12 of this year. I just wanted to make sure that --

13 MR. KURITZKY: Nothing --

14 CHAIR STETKAR: -- that's still the price.

15 MR. KURITZKY: But no, it's a good while,
16 I meant to mention that. The high winds, we did not
17 go ahead and do the Level 2 initially because we were
18 at limited resources. And we felt that we wanted to
19 put a lot of effort on the fire, make sure we didn't
20 short change it.

21 But now I think we have enough that we can
22 at least do some work on the high wind 2 issue.
23 That's going to start in parallel with the reviews of
24 the fire.

25 Okay, so moving on to the low power and

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1 shutdown. We have since the last October meeting,
2 we've completed the Level 1, low power shut PRA for
3 internal events. That is now going through project
4 management review. Initial project management review
5 comments have been provided. They're being addressed
6 right now.

7 The Level 2 PRA, again another topic for
8 the closed session. The model again, has been
9 completed, just like the fire and seismic. It is now,
10 it has been provided to the Level 3 team so they can
11 start doing the consequence analysis. And the main
12 task to be finished, are the uncertainty analysis, the
13 propagation of parameter uncertainties, as well as
14 completing the self-assessment.

15 MEMBER BLEY: Alan, before you leave that
16 one, and as a preliminary to what comes this morning,
17 can you give a brief overview of how you've used the
18 results of this low power and shutdown PIRT to -- in
19 what way you used that in the low power and shutdown
20 analysis?

21 Have you really truncated that analysis in
22 many places as a result of the PIRT, or what did you
23 do with it?

24 MR. KURITZKY: Okay, so very good
25 question, Dr. Bley. And --

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1 MEMBER BLEY: Why, thank you.

2 MR. KURITZKY: Because it's --

3 MEMBER BLEY: It may cover my comments on
4 the PIRT.

5 MR. KURITZKY: It's fairly nuanced,
6 because the reality was we recognized that we needed
7 to have an expert elicitation -- because of the
8 limited resources, we knew we weren't going to be able
9 to do everything on our low power shutdown PRAs. We
10 wanted to somehow focus our attention on what we felt
11 would be the most risk significant aspects.

12 So, the idea came up to do this PIRT
13 expert elicitation because also there's an SRM out
14 that told us to use the Level 3 PRA project to pilot
15 the staff's approach or for expert elicitation. So we
16 engaged on this one.

17 However, the timing was such that by time
18 the whole project got, the PIRT got set up, so it was
19 clear that the results weren't going to come in. We
20 couldn't wait around for results to come to move
21 forward on our shutdown PRA, otherwise the schedule
22 would drag out too far.

23 So we convened a kind of preliminary PIRT,
24 where there was a number of the members from the PIRT
25 that met under the auspices of an expanded TAG

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1 meeting. And so we went over what they felt were the
2 main risk driving areas. And we used that information
3 to help focus what we worked on for our low power
4 shutdown PRA.

5 MEMBER BLEY: Explain focused, a little
6 bit.

7 MR. KURITZKY: Well, yes --

8 MEMBER BLEY: What do you mean by focused?

9 MR. KURITZKY: Oh, okay, so in other words
10 --

11 MEMBER BLEY: Does that mean not looking
12 at some things?

13 MR. KURITZKY: Yes. Focused means --

14 MEMBER BLEY: It means assuming some
15 things are perfect, and you're only analyzing what --

16 MR. KURITZKY: No, absolutely not --

17 MEMBER BLEY: -- what you were playing
18 with?

19 MR. KURITZKY: Absolutely not, nothing,
20 there's nothing --

21 MEMBER BLEY: Then how did you focus?

22 MR. KURITZKY: Okay, so as you are well
23 aware, there's nothing perfect in a PRA, any PRA,
24 anywhere. So it's a model, and has limitations, it
25 has boundary conditions, it has uncertainties. But

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1 what we use --

2 MEMBER BLEY: Well, I'm sorry there's two
3 ways to cut out parts you don't want to spend the time
4 working on. One is to throw it away, which is
5 essentially assumes it's perfect. Because it has no
6 contribution risk anymore because you can't see it.

7 And the other is to use some bounding
8 values or conservative values for that part of what of
9 what you want to take out. And then at least you
10 haven't thrown it away.

11 MR. KURITZKY: Right.

12 MEMBER BLEY: So which of those two did
13 you use?

14 MR. KURITZKY: Okay, so it was a mix. It
15 was a mix of both of those. So there were some things
16 that we scoped out, not because we believed they were
17 perfect, but because we had to make choices, and make
18 priorities. And so there are things that we took out
19 of scope.

20 And then there are also things that we
21 made conservative assumptions because we didn't have
22 the resources to do a very detailed analysis, but we
23 wanted to at least -- we felt that those things were
24 important enough that we wanted to at least have some
25 contribution from it. We didn't want to lose the

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1 contribution, throw them away.

2 And there were other things that we were
3 able to work on with more detail. So it was kind of,
4 you know, different levels of effort depending on how
5 important we felt the different areas were to the PRA.

6 And that was the whole purpose of the PIRT
7 was to help us identify which were the ones we should
8 focus more resources on, and which were the ones we
9 could either focus less resources on or --

10 MEMBER BLEY: Okay, and too when we talked
11 about the PIRT, there's some real hazards of not
12 looking at some things because the PIRT said they
13 weren't important.

14 MR. KURITZKY: Right, and that risk, I
15 agree. That's always a risk when you write something
16 out of your scope that you're overlooking some reason
17 why it might be --

18 MEMBER BLEY: But if you bound it, then
19 it's still there. You can always --

20 MR. KURITZKY: The problem is if you bound
21 every -- if you don't have much information, the less
22 information you have the bounding gets more and more
23 conservative. And at some points it greatly
24 overwhelms what you're analyzing and gives a very
25 distorted picture.

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1 MEMBER BLEY: Which means maybe it's worth
2 looking at. Go ahead.

3 MR. KURITZKY: Possibly, but it depends
4 again, if you don't feel it's important, but you don't
5 have enough information to demonstrate that, you still
6 go with your expert judgement, or your reasoned
7 judgement that I don't want spend a lot of resources
8 on that. But yes, I don't want to skew my results
9 just because I didn't spend a lot of resources on
10 that.

11 So again, it's a mix of each of those
12 options that you mentioned, Dr. Bley. So going back,
13 the preliminary work that we did with the expanded TAG
14 was to identify those areas that we felt were more
15 important. We already had some ideas on what we
16 wanted do.

17 We meet with our contractors to do our own
18 kind of, we came up with criteria for what things we
19 felt would be the most important drivers. And then
20 those that met most of the criteria were the ones that
21 we focused on. And then the other ones were left out.

22 MEMBER BLEY: But let me offer something.
23 I was going to wait for the PIRT, but I'm going to
24 say it here. The first thing that got me nervous
25 reading through the PIRT, was the second paragraph of

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1 the Executive Summary, which in its first sentence
2 says, the PIRT approach applies a structured process
3 for eliciting judgements -- that's pretty good -- from
4 technical experts about typical technical questions --
5 then -- in lieu of other means such as test
6 urinalysis, which may be resourced intensive where
7 implausible.

8 Usually you use this, and your words
9 implied you did, not in lieu of, but to let you set
10 priorities in what you look at. This sounds rather
11 like one uses a PIRT as a way not to dig into areas
12 that might be of interest. That sentence bothered me,
13 and I'll get more to that when we get into the PIRT.

14 CHAIR STETKAR: And just because this is
15 an open session, I don't want to go into details that
16 we may discuss in the closed session.

17 I will now admit that I am even more
18 confused than I was about what you did and didn't do
19 and why you did it, and didn't do it in the low power
20 and shutdown, both Level 1 and Level 2.

21 Because I can't find easily documentation
22 that tells me we bounded something -- I think you used
23 that term -- we took an approach that might be
24 conservative for something for the following reasons.

25 And here's what we did and why we did it.

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1 Conversely, we didn't look at something at
2 all. We assigned it zero for the following reasons.

3 MEMBER BLEY: Now I'm assuming the low
4 power and shutdown analysis which we haven't seen yet,
5 will lay that out clearly.

6 CHAIR STETKAR: Well, that's what I'm
7 saying on the public record. I've read it, and I
8 haven't seen it.

9 MEMBER BLEY: Oh.

10 MEMBER REMPE: So to further harp on --

11 CHAIR STETKAR: Well just, and that's just
12 on, remember we're in public session here so we can't
13 go into too many of the details of a table that I'm
14 looking at right now.

15 MEMBER REMPE: When I was looking at it, I
16 saw your slides that are coming up on the overview of
17 the PIRT, and that's the one place I found it
18 documented. We didn't have the PIRT in time to use it
19 for the low power and shutdown. I don't think it's in
20 the low power shutdown document, saying we didn't use
21 this PIRT. I don't think it was in the PIRT saying we
22 didn't use it. And so --

23 MR. KURITZKY: Well but --

24 MEMBER REMPE: But furthermore, in the
25 past, we've made comments, or I know I have, saying it

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1 would be really nice up front in each of these
2 documents if you'd talk about what the scope is, what
3 the limitations were, what the key insights are? And
4 I really think it would help the readers on this and
5 just in general.

6 And there's another comment I wanted to
7 make that's probably not in your overview slides, it
8 would be in, that are high level comments that I'd
9 like to use this opening session for. And so we won't
10 get into details but just general things that when I
11 go through these documents that help me.

12 MR. KURITZKY: Okay, thank you. So to get
13 back to low power shutdown scopes. In the report, and
14 you're correct, we don't discuss the PIRT because it
15 comes afterwards. So that's not in there, but there
16 is a section that does identify the criteria we used
17 to determine what we were going to include in the
18 model. That's laid out very clear.

19 We don't have a section as you just
20 mentioned that talks about well we, these things we
21 did a full study. These things we did bounding.
22 These things we did a detailed analysis, or we left
23 out completely. But the criteria, when we discuss,
24 that tells you what we did or didn't include.

25 The extent that we modeled something was

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1 in there. That's just, there's nothing that talks
2 about that specifically, but you'll see the number of
3 assumptions and values. So it's not that we tied it
4 one-to-one, this area we did a more detailed, on this
5 we didn't.

6 Rather you have to look at the assumptions
7 and boundary conditions. And that tells you what kind
8 of things, you know, that we didn't go into to as much
9 detail. We made this assumption. We made that
10 assumption. Or we didn't look at this. Or we didn't
11 look at that.

12 Those things are in the report. I just
13 reviewed it, the reports. I know those things are in
14 there. But it's not quite laid out the way I just
15 spoke to respond to Dr. Bley.

16 CHAIR STETKAR: Yes, and that's I think
17 what we've been reacting to, is there is -- we
18 recognize you didn't use the PIRT. So therefore the
19 PIRT report is basically irrelevant to anything that
20 we're going to talk about today, this afternoon.

21 But you did say that you used some sort of
22 expert judgement to guide those, I'm going to call,
23 it, well priorities.

24 MR. KURITZKY: Right.

25 CHAIR STETKAR: Of how things are

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1 addressed or are not addressed?

2 MEMBER BLEY: Which must have included
3 this post-PIRT --

4 MR. KURITZKY: Pre-PIRT.

5 MEMBER BLEY: No, it's the post session
6 where you had, well before it was published, but you
7 had the same people helping you out.

8 MR. KURITZKY: That was before, that's a
9 pre -- that was before we --

10 MEMBER BLEY: Pre, okay.

11 MR. KURITZKY: That's when we realized as
12 we were putting the contract together and trying to
13 get live, that we weren't going get the work in time.

14 So we did a pre --

15 CHAIR STETKAR: Right now, I view the PIRT
16 exercise as an interesting exercise in the use of
17 expert judgement, that seems to be focused on a low
18 power and shutdown PRA.

19 MR. KURITZKY: Yes.

20 MEMBER REMPE: But it -- it might, I mean
21 since you've spent all the money to do the PIRT. You
22 going to try and do something in the future with it?
23 Because you've got it, compare it to the results from
24 your low power and shutdown?

25 MR. KURITZKY: But what --

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1 MEMBER REMPE: We can talk about that one
2 later, but --

3 MR. KURITZKY: But we can talk about it.
4 So what we did was once it was completed then we used
5 it to go back and look to see whether or not what we
6 did was consistent with what the PIRT, okay? And we
7 felt that yes, in fact what we did was pretty
8 consistent with what the PIRT found.

9 And in terms of, that's actually -- I
10 don't want to take all of Jeff's presentation -- but
11 that was one of the main reasons we actually now
12 worked on the NUREG/CR. Because we felt a lot of the
13 insights from that PIRT would have value outside of
14 the project. In other words, when PNNL completed the
15 expert elicitation document, we got that as a letter
16 report.

17 But because of the preponderance of
18 proprietary information that was designated as
19 official use only, and we could only use that inside
20 the agency. So we felt there was information that
21 might be useful in the broader PRA technical
22 community.

23 So that was the genesis or the reasoning
24 for us having PNNL, then go and develop this NUREG/CR
25 that can now be released publicly and allow others to

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1 benefit from the work. Particularly, because like I
2 said, the timing was such that we didn't get the full
3 benefit of it. So now at least we can provide it to
4 the community.

5 MEMBER BLEY: Since we're having this kind
6 of broad discussion now. I'm going to offer a few
7 thoughts related to the PIRT, which comes up a little
8 later. But I'd rather get out in front of you folks.
9 So maybe you can address them as we go through the
10 PIRT, rather than now.

11 I had a few kind of high level
12 difficulties with that analysis. The first was when I
13 look at your group of experts that were on the panel.
14 And you have a lot of people with a lot of PRA
15 experience. And some of them I know have done one or
16 several shutdown PRAs, that's good.

17 I don't see, and I don't know everybody
18 there, but I looked at the resumes, anybody who is a
19 real expert in the severe accident side of the issue,
20 the Level 2, the Level 3 parts which are also
21 important to the kind of issues you looked at.

22 The main thing that bothered me though was
23 how you decided to implement the PIRT. And I'll tell
24 you why in a minute. When I looked at the main report
25 and the appendices, the guidance from the TAG, I

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1 though was pretty good. It was focused on the kind of
2 things one usually tries to look at with a PIRT.

3 And to me, if the focus had been on things
4 like maintenance configurations, and initiating event
5 frequencies, manual versus automatic activities at a
6 particular plant, the kind of issues that can drive
7 results. And it had been focused for this particular
8 plant, I think it would have been much more useful.

9 Now you have that, I forget what you
10 called it, but in addition to the PIRT you had that --

11 (Off microphone comment)

12 MEMBER BLEY: -- brainstorming session.
13 That was more focused on the kind of stuff I thought
14 the whole thing should be focused on. My problem with
15 the way you focused it, looking at things directly
16 that are related to plant operating states and outage
17 types.

25 And I suspect that's what you got.

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1 Because the PRA people were telling you, I expect they
2 were telling you, what things ended up being important
3 in the very specific analyses they have been involved
4 in. The results might be very different for this
5 particular plant.

6 In the past, there's a number of cases
7 where people tried to take existing PRAs and fiddle
8 the results a little bit by a few plant specific
9 differences. And when you actually did a PRA for
10 those plants you found out that kind of approach
11 didn't work very well. And you missed most of the
12 things that were important.

13 In detail, I would expect this approach
14 has the same problem. So, I wish you had focused more
15 on phenomenological kind of things, the key issues,
16 rather than on contributors to the various risk
17 measures. Because I think all you're getting is a
18 compendium of what showed up in previous PRAs, and
19 especially given the composition of the panel you had.

20 And a few of them, you said you had nobody
21 -- I didn't mention that, I noticed that too -- you
22 had nobody with real seismic experience although a
23 couple of those people have done seismic PRAs. But
24 somewhere in there you said, well gee, there are such
25 holes in our information, like we don't know the

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1 seismic contributions here.

2 Seismic is the same for shutdown as it is
3 for power. I don't get what the heck you're talking
4 about there. So I think there was a general misfocus,
5 and to me, a kind of corruption of the guidance you
6 got from the TAG. I don't find the results of the
7 PIRT very useful for those reasons. I'm suspect that
8 they're really just a compendium of previous shutdown
9 PRAs. Enough said.

10 Oh, and there's a lot of -- almost enough
11 said. There's a lot of good process information in
12 these two documents. How you did it. The substance
13 was the side I'm concerned with.

14 MR. KURITZKY: Okay, thank you very much,
15 Dr. Bley.

16 MEMBER BLEY: And one last thing.

17 MR. KURITZKY: Is this a Columbo episode?

18 CHAIR STETKAR: I was going to say, he's
19 starting to look like Columbo.

20 MR. KURITZKY: I'm not going to admit to
21 it.

22 MEMBER BLEY: AHP, you sing its praises.
23 And you never talk about the downside. And if you
24 review the literature, you'll find there's an awful
25 lot of worries and complaints about the downside. You

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1 really ought to be fair about that presentation.

2 That's enough said.

3 MR. KURITZKY: Thank you. Okay. All
4 right, I think we're done with this one.

5 Okay, moving on to spent fuel pool.
6 That's an area that is a lot of ongoing work that was
7 started a little bit later than many of the other
8 areas. And drifted for a while because of the lack of
9 personnel to work on it. Right now we're making some
10 good headway.

11 The Level 1 aspects are pretty much
12 complete. We initially had looked at two primary
13 cases. We looked at seismic events causing sloshing
14 in the pool. And then seismic events causing leaks in
15 the spent fuel pool in combination with sloshing.

16 We've since now gone back and added some
17 additional scenarios. We're now looking at non-
18 seismically induced reactor site leaks by themselves.

19 And then also seismically induced reactor site leaks
20 in combination with spent fuel pool sloshing.

21 And seismically induced reactor site leaks
22 in combination with sloshing and spent fuel pool
23 leaks. So those are some additional scenarios that we
24 felt we wanted to address. All that work is pretty
25 much starting to wrap up.

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1 In parallel we've been doing work on the
2 Level 2. There we've pretty much completed the
3 deterministic aspects of the work. We made
4 essentially all the MELCOR runs. We're now working on
5 the probabilistic aspects, focusing on completing the
6 Level 2, event tree. And we're also quantifying the
7 model to come up with the reduced category
8 frequencies.

9 Some other work that's still ongoing there
10 too is the HRA, Human Reliability Analysis. Most of
11 that work has now been completed. There was some that
12 was still being done when I made the slide. But
13 essentially most of that now is complete. So what
14 really remains there is also just like some of the
15 Level 2 models, we need to complete the uncertainty
16 analysis, and also the self-assessment.

17 CHAIR STETKAR: Alan, I'll raise it now
18 because I know in a couple of slides you're going talk
19 about the integrated site PRA. But because Dr. Bley
20 gave me an opening to talk about it a little bit now.

21 I noticed in your PIRT, you explicitly
22 told your PIRT team to consider only the reactor
23 vessel. Now in my experience, I would have not
24 restricted the PIRT team to that because there are
25 plant operating states, configurations, operational

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1 evolutions that couple the spent fuel pool and the
2 fuel in the reactor, leading to risk in both places.

3 And you're going say, well we're going to
4 somehow address that in the integrated PRA. But if
5 you relied only on the PIRT, restricting their vast
6 experience to only the reactor vessel, you might have
7 lost insights about particular vulnerabilities where
8 both could be affected by a particular -- and I don't
9 care whether it's a seismic event, or an internal
10 event, or a fire or whatever it is.

11 So, I'm curious, I'm still kind interested
12 to see how you're going to link those insights among
13 the two units and the spent fuel pool? Because
14 that's, it's more than just a bookkeeping exercise.

15 MR. KURITZKY: Right.

16 CHAIR STETKAR: So I brought it up here
17 because this is a slide that just says spent fuel
18 pool. We just heard a little bit about low power and,
19 you know, shutdown for example. And I'll give you a
20 couple of slides to kind of think about it before you
21 get to the integrated one.

22 MR. KURITZKY: Well first I'd just like
23 to, just right now to point out, I mean the point
24 would be what I mentioned earlier on in the first
25 bullet here is we initially had looked at just spent

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1 fuel pool specific scenarios. But because of that
2 same reason, when the transfer canal was open and you
3 have a connection between the reactor side and the
4 spent fuel pool, that was the reasoning why we looked
5 at some of those scenarios now. So they're really
6 being looked at under the spent fuel pool PRA.

7 (Off microphone comment)

8 MR. KURITZKY: Right, so I mean that one
9 we didn't really have to punt to the integrated
10 services, but it's going --

11 CHAIR STETKAR: But when you say you're
12 looking at it from the spent fuel pool PRA, that's,
13 how are you looking at the vulnerability of fuel in
14 both locations?

15 MR. KURITZKY: That --

16 CHAIR STETKAR: Who's looking at that?

17 MR. KURITZKY: Right. So what we're
18 looking at really is just from the spent fuel pool
19 side. We haven't --

20 CHAIR STETKAR: Yes, that's, see that's my
21 concern.

22 MR. KURITZKY: Right. Yes, and that would
23 be more, that would, that specific concern would be
24 the integrated site risk piece.

25 CHAIR STETKAR: Okay, that's --

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1 MR. KURITZKY: Right, but at least from
2 the spent fuel pool, the effect of the water on both
3 when they're connected is being addressed by spent
4 fuel pool PRA. The potential damage to fuel in both
5 locations is an integrated site risk issue.

6 CHAIR STETKAR: Because the water goes,
7 the water can in principle, or the cooling can go away
8 from both places.

9 MR. KURITZKY: Right.

10 CHAIR STETKAR: Simultaneous, due to a
11 single cause.

12 MR. KURITZKY: Right. And that in fact
13 that's the reason why we add those scenarios to the
14 spent fuel pool PRA, because our seismic people
15 recognize that there are certain seismic frequencies
16 that you are likely to have damage to, not likely, but
17 the potential to have damage to the spent fuel pool
18 and the reactor.

19 CHAIR STETKAR: Right.

20 MR. KURITZKY: And cause leaks in both at
21 the same time.

22 CHAIR STETKAR: Right.

23 MR. KURITZKY: And again particularly when
24 you have that transfer canal open, then you have a --

25 CHAIR STETKAR: But when you're looking at

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1 integrating -- well we're going to get off. You still
2 have ten minutes here, so we can ramble a bit.

3 When you're looking at personnel actions,
4 especially in mitigation actions if you want to call
5 it that, whether you want to call it pre-core damage
6 or incipient core damage, or post-core damage. You
7 know, setting priorities on site for, you know, what
8 do you do first?

9 Those types of, the fact that things are
10 going bad in both places could possibly affect how you
11 think about those scenarios. And certainly would
12 affect how people in the plant think about them.

13 MEMBER BLEY: But that also raises a PIRT
14 issue I want to toss in here. And that is, you speak
15 somewhere in those reports that one of your lessons
16 learned was it would have been really good to bring
17 your experts in earlier in more discussion on the
18 basic parameters of what they were looking at.

19 And I don't recall if that came up in the
20 post individual group session, or if it came up in the
21 brainstorming sessions. Did anybody bring up this
22 kind of issue anywhere along that line? Now I would
23 have hoped they would have been kind of stretching
24 their boundaries. That's what you really hope the
25 people are doing, a PIRT would be doing.

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1 MR. KURITZKY: I'll have to yield. I know
2 Jeff or --

3 MEMBER BLEY: Steve.

4 MR. KURITZKY: Steve, anybody, do you
5 know?

6 MR. SHORT: Yes, I think when we had our
7 PIRT sessions, especially in the, with the group
8 meeting.

9 MEMBER BLEY: Yes.

10 MR. SHORT: There was quite a bit of
11 discussion about that interface between the pool and
12 the containment building. And so, we're going to get
13 to that in a little bit, but as far as the PIRT
14 parameters and how we structured the parameters?

15 I don't remember the specific comment that
16 we have, but I do, we did have a lot of interaction
17 with the PIRT panel on what those parameters should be
18 and how we evaluate each plant operating state.

19 So, I'd have to go back and look at that
20 specific comment. But we did change the plan, we did
21 change our parameters quite a bit based on
22 interactions prior to the combined meeting on what
23 those parameters ought to be and what are the
24 principal things we ought to be looking at to do the
25 paralyzed comparisons on that?

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1 MR. KURITZKY: So, maybe you can identify
2 the comment, because I don't --

3 MR. SHORT: That's not in the
4 presentation.

5 MR. KURITZKY: Okay.

6 MEMBER BLEY: You got lessons learned in
7 there somewhere, you must. Because you've got it in
8 the report.

9 MR. KURITZKY: Okay. So moving on to dry
10 cask storage PRA. This one's quick because it's the
11 same viewgraph you saw six or seven months ago. As I
12 mentioned before, it's been sitting in the on-deck
13 circle for project management review. And that review
14 was started. The reviewer was diverted to other stuff
15 and hasn't been able to pick it up until just a few
16 days ago. And so hopefully this one now will get
17 moved through the chute.

18 Integrated site PRA, another area that
19 really hasn't seen a lot of change since the October
20 meeting. The only thing that really is new, is on the
21 third bullet, the last two sub bullets, we did two
22 more, completed two pilot studies. A two unit Level 1
23 PRA for internal fires. And a two Unit Level 1 PRA
24 for internal events, where one unit is operating, and
25 one unit is shutdown.

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1 In fact, we still haven't been briefed on
2 the results of those, but those were completed.
3 That's pretty much the whole suite of pilot studies
4 we're going to do.

5 So now, work going forward is going to
6 focus on some of the systematic techniques that were
7 discussed previously based on feedback from the ACRS
8 Subcommittee Members, as well as our TAG.

9 We wanted to look at other techniques to
10 make sure nothing has slipped through the cracks. Our
11 focus on the, focusing on the results and insights
12 from the single-source PRAs to prioritize what we look
13 at for multi-source. There was some concern that we
14 might be missing some things. And so there's a number
15 of activities that we're going to undertake.

16 For instance, looking at what we screened
17 out, or what we left out of the single-source models
18 to make sure that none of those things might have
19 outside impacts in a multi-source environment.

20 Also looking at for instance, all the
21 interdependencies that might occur between the
22 different sources, as well as looking for instance at
23 operating experience with multi-source type of
24 conditions.

25 So there's a number of those activities

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1 which we are now going to do as we wait for the
2 single-sourced models to be finalized. And then
3 actually start looking at the full integrated --

4 MEMBER BLEY: Alan, can you tell us a
5 little bit about what it means to have a pilot
6 application on it?

7 I'm guessing some group, a couple of
8 people come up with an approach, and somebody else
9 then tries to apply it, or?

10 MR. KURITZKY: Yes, we came up with an
11 approach for how we would address these things.

12 MEMBER BLEY: Yes.

13 MR. KURITZKY: The approach is kind of
14 general because it needed to cover a lot of different
15 areas. And so these pilot things with our contractor,
16 Energy Research, Inc. would take, as we got initial
17 results done from the single-source models -- and
18 again, those didn't have to be final because this is
19 just in a pilot thing.

20 So, once we had initial results ready,
21 they would take those, particularly the cut sets et
22 cetera, and they would go through and apply the
23 approach to there to make sure that it would work and
24 that we wouldn't end up running into either, you know,
25 size problems where things didn't come out the way we

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1 thought they would.

2 So, you know, they're looking, the basic
3 approach is to take the dominance, because we can't
4 put all the information into one big mega model. So
5 we're looking at the dominant contributors. Whether
6 it be the 99 percent, you know, cut sets that at the
7 99 percent, but then also digging deeper to get things
8 like, that involved operator actions or common cause
9 failures, things that we already know are likely to be
10 important for multi-source risk. So we had this
11 approach for how we go in and pull those things in.

12 Excuse me, and so then we went through and
13 do those approaches. See what come out and see
14 whether or not, yes, it looks like we are catching
15 what we need to. We can do the logistical, and
16 putting the things together, and we're coming out with
17 things that are meaningful to us. And so, that's
18 essentially what those pilot approaches do.

19 MEMBER BLEY: Okay, have you had to make a
20 lot of changes through the process, or?

21 MR. KURITZKY: I don't, I don't remember
22 the details. I don't think there was any, I don't
23 think we had any major showstoppers. I mean there's
24 things where we, oh, let's adjust this a little bit or
25 that a little bit. But there hasn't been any major

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1 issues that have come up.

2 MEMBER BLEY: Thanks. I want to --

3 MEMBER REMPE: Well, okay, this is off
4 topic again, but I don't know of a better place --

5 CHAIR STETKAR: Topic, let me, because I
6 have something on topic here. I see five bullets
7 here, sub bullets. The first thing that raises a
8 question is why don't I see a bullet that says,
9 Reactor Units 1 and 2 at power, seismic events, Level
10 2 PRA?

11 MR. KURITZKY: Because that, we just got
12 results for that.

13 CHAIR STETKAR: Oh, that's, okay.

14 MR. KURITZKY: Yes, so --

15 CHAIR STETKAR: So there's more, I guess I
16 wasn't --

17 MR. KURITZKY: Well, no.

18 CHAIR STETKAR: -- listening close enough,
19 there's more in progress here?

20 MR. KURITZKY: No, that's what I just
21 mentioned. This is essentially the suite we'll -- it
22 would be nice if we could have done more of them. But
23 the bottom line is now we've spent enough. We don't
24 really have the resources to keep doing more and more
25 pilots on this.

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1 At this point, between this -- and this
2 wasn't a prioritized list. This was just using
3 whatever was available from the Phase 1 work
4 essentially as it became available. So these are the
5 first five or so that were available. And so we went
6 and did these pilot studies.

7 Now, we're at a point where we can't spend
8 any more time doing pilot studies. We need to --

9 CHAIR STETKAR: Do the real one.

10 MR. KURITZKY: -- look at some of these
11 other techniques and then get the actual full model
12 going, so.

13 MEMBER BLEY: So the risk for you is some
14 of these other areas you might run into trouble.

15 MR. KURITZKY: We might run into trouble --

16 -

17 (Simultaneous speaking)

18 MEMBER BLEY: That's what I was --

19 MR. KURITZKY: And that's just a project
20 risk that we have to take.

21 CHAIR STETKAR: The concern that I would
22 have would be the shutdown seismic and the full power
23 seismic out through Level 2.

24 MR. KURITZKY: Right.

25 CHAIR STETKAR: For example.

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1 MR. KURITZKY: We're not falsely confident
2 that just because we managed to successfully navigate
3 these five pilots studies that there will be no issues
4 going forward.

5 CHAIR STETKAR: Okay.

6 MR. KURITZKY: We recognize that that is
7 just a, that's a project risk.

8 CHAIR STETKAR: Okay.

9 MEMBER REMPE: Now?

10 MR. HUDSON: Good morning, I'm Dan Hudson,
11 Office of Nuclear Regulatory Research, Division of
12 Risk Analysis, and I'm the integrated site PRA
13 technical lead for this project. To the points that
14 you've been raising, it would be extremely helpful if
15 ACRS Members are aware of any particular issues or
16 concerns that you might have about extending this into
17 the seismic low power shutdown, Level 2 PRA space.

18 If there's particular issues that you have
19 concerns with, we'd appreciate it because we very much
20 focused on evaluating the technical feasibility of
21 doing this work using the available tools that we
22 have, and the process that we developed.

23 And as Alan mentioned, we haven't
24 encountered any specific barriers to implementing the
25 approach that is going to require a major change to

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1 our process. But again, as Alan has mentioned, we've
2 had to necessarily limit the scope these pilot
3 applications that we can undertake.

4 CHAIR STETKAR: We can talk a little bit
5 this afternoon, because I had some concerns focusing
6 only on, you know, one unit for example. And by
7 implementation they would apply, you know, site wide.

8 But that's for this afternoon because
9 we'll talk more in detail about the Level 2 and the
10 low power and shutdown models this afternoon.

11 And now, Joy.

12 MEMBER REMPE: All right. So in the, at
13 power discussion last, or for internal events last
14 November there were some concerns expressed not only
15 by me, but I also believe, Mike mentioned, about
16 uncertainty with respect to Level 2 phenomena, vessel
17 failure, MCCI.

18 And when I was looking at the Level 2
19 documentation for low power and shutdown, now I'm
20 seeing stuff coming up about we need to start thinking
21 about basemat failure. And I think that it would
22 behoove you as you write up this documentation, to
23 acknowledge more carefully about -- I know you have to
24 use the current tools -- but the ability to model
25 holdup on ex-vessel structures. The ability to

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1 predict failure.

2 And the current capabilities of MELCOR
3 versus other codes such as MELTSPREAD and CORQUENCH
4 that Argonne has, differs. And we're learning a lot
5 from Fukushima and I think that it would be better to
6 reevaluate some of the discussions about that
7 throughout. Not just this low power and shutdown
8 documentation, but at the internal events.

9 And we'll talk more details this afternoon
10 on some statements that are bugging me. But I just
11 wanted to get it out here in the open session, okay?

12 MR. KURITZKY: Okay. Thank you.

13 MEMBER BLEY: But even if they can't
14 address some of these because it goes beyond state-of-
15 the-art modeling, those issues ought to be addressed.

16 MEMBER REMPE: Yes, they ought to be
17 commented on, and then instead of saying, maybe we
18 need to think about basemat failures. Maybe we ought
19 to think more about better models in MELCOR for ex-
20 vessel debris coolability and holdup on structures.
21 And that's where I'm coming from, than a more state-
22 of-the-art opinion in the documentation.

23 MR. KURITZKY: Okay, thank you, Dr. Rempe.
24 Okay, so on the record also, so Dan now you know you
25 have to be here for the whole afternoon session also.

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1 || (Laughter)

2 MR. KURITZKY: Okay, moving forward. So
3 just a few upcoming milestones. Some things that we
4 hope to get done. The wind is at our backs over the
5 next few months.

11 We also hope in the next month to have a
12 couple of reports ready for the TAG review. Both the
13 Level 1, internal fire PRA, as well as the Level 1,
14 low power shutdown PRA for internal events. Both
15 those we hope to pass on to the TAG.

16 Before the end of next month we also, the
17 following month, hope to get the dry cask storage PRA
18 to them. That covers all PRA levels and all hazards.

19 And then also the seismic level and seismic PRA, that
20 one though will probably be pushed back to July or so.

Because again, as I mentioned no, we haven't had a chance to start doing the project management review on that yet. It's still in the queue.

24 And then later in the year, the two models
25 that you're going to hear about this afternoon, or in

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1 the closed session, the one for the -- well actually I
2 guess three models. Fire and seismic, Level 2 PRAs as
3 well as the low power shutdown, Level 2 PRA, we hope
4 to get those into the TAG sometime in the fall.

5 CHAIR STETKAR: And I think, one thing
6 I'll add to this, and I think we'll probably talk more
7 about it this afternoon in closed session. We
8 collectively need to start thinking about a strategy
9 for bringing "the study", whatever the study is to the
10 full open Subcommittee meetings.

11 Because most of our Subcommittee meetings
12 have been either open and closed, or completed closed.

13 And then eventually, to the full Committee for
14 deliberation. So that I'm sure is on your radar, and
15 we should start to think about timing and strategy for
16 doing that. And we can do that in closed session.

17 MR. KURITZKY: Yes, in fact that last
18 topic that is really on the agenda, but that future
19 interactions is supposed to --

20 CHAIR STETKAR: Yes.

21 MR. KURITZKY: -- but we're going to
22 discuss then, completely with the full Committee too.

23 CHAIR STETKAR: Thank you.

24 MR. KURITZKY: Okay, as so lastly just
25 wanted to recognize again, now this was a very big

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1 joint effort. This has not only involved all the
2 three research divisions, but it's gotten significant
3 support from many staff members from most of the other
4 NRC offices.

5 We've also gotten tremendous support from
6 our, both our National Lab contractors and our
7 commercial contractors. And a lot of, also
8 organizations that have contributed mightily to the
9 project. So it's really been one big group effort.

10 Also, of course we can't leave it without
11 being said, the feedback from the Subcommittee Members
12 has been very valuable also, so we thank you for that
13 too.

14 MEMBER SKILLMAN: Alan, would you go back
15 a slide please?

16 MR. KURITZKY: Yes.

17 MEMBER SKILLMAN: My question is what
18 gives you confidence that the experience, depth of
19 knowledge, competencies of the TAG members is
20 sufficiently broad and deep, that your final product
21 is at the quality that you want it to be?

22 MR. KURITZKY: Well, so there's multiple
23 answers to that question, which is an important issue.

24 And there's an easy not satisfying answer that says,
25 that's all we can do because we no longer have the PWR

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1 Owners Group. We don't have funding to have an
2 external review group, you know, do any additional
3 work. So, we're limited to essentially, in-house
4 resources.

5 But in that regard, the TAG is comprised
6 of, specifically comprised of those people in the
7 Agency that are the most senior and experienced in
8 these areas, in the PRA areas, in the supporting areas
9 like deterministic analyses, MELCOR, or consequence
10 analysis, EP, structural analysis.

11 So the TAG has exclusively been put, or
12 specifically been put together to get the top
13 capabilities in the Agency to be able to review this
14 work. So it's really as good as we can do inside
15 based on that.

16 The limitation though will be, and just
17 like as has been with every aspect of this project, is
18 getting those people focused on this work. They're of
19 course, have many other responsibilities. They are
20 sought out there by many, for many projects, and many
21 purposes and agencies.

22 So getting them to focus a lot of their
23 time on this is going to always be a challenge. Plus
24 the fact if you look at the schedule, you see that all
25 of a sudden after a big long gap, we're dumping a

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1 whole bunch of reports on them in a short period of
2 time. And we don't really have enough schedule
3 flexibility to let them stagger them out into, over a
4 long period of time.

5 So they are going to be forced to look at
6 a lot of them, in a shorter period of time. So that's
7 going to require some careful maneuvering of the
8 pieces on the chess board by the Chairman, Nathan Siu,
9 who is about to talk to you, on how he's going to try
10 and handle, you know, that.

11 So, we're probably not going to be able to
12 rely on as detailed a review as we initially had
13 hoped. But we just have to make do with the best we
14 can. But Nathan.

15 MR. SIU: Yes, Nathan Siu, Office of
16 Research, and the Chair of the TAG that's going to be
17 receiving this pile of work shortly. I think, Alan,
18 another challenge that we face of course, many of the
19 TAG members are very knowledgeable about this,
20 mechanisms, and modeling, and so forth.

21 But in terms of complying with the PRA
22 standard and practices, and actually applying these
23 models, in a real PRA sense, not all of us have that
24 kind of experience. So we may have to figure out
25 what's the best we can do, given that you don't have

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1 the PWR Owners Group support.

2 MEMBER SKILLMAN: Thank you.

3 MR. KURITZKY: And thank you, Nate. Okay,
4 so that was the last slide I had. If there's any
5 other questions?

6 (No audible response)

7 MR. KURITZKY: Then we can move onto the
8 next presentation, which is the low power shutdown
9 PIRT, expert elicitation and Jeff Wood is going to
10 start that up, as soon as I can get the slides.

11 MR. WOOD: Thanks, Alan. So my name is
12 Jeff Wood, NRC Office of Nuclear Regulatory Research.

13 And I'm just going to be introducing this topic of
14 the Phenomenon Identification and Ranking Technique or
15 PIRT on the low power and shutdown PRA modeling
16 priorities.

17 We had the Pacific Northwest National Lab
18 form this PIRT for us. So we have Garill Coles and
19 Steve Short here. They're going to present a more
20 detailed overview of the project. And I'm just
21 introducing it from the NRC perspective.

22 And I wanted to just mention a bit, what
23 were the motivations for this project?

24 CHAIR STETKAR: Jeff, before you start on
25 this slide, I need to understand something in terms of

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1 the motivation because of the way that the things that
2 I read in the PIRT report are presented? And this
3 slide kind of reinforces my concern.

4 This slide says, apply PIRT to low power
5 shutdown PRA modeling priorities. Was the purpose of
6 this exercise to generically draw conclusions about
7 low power and shutdown modeling priorities? Or was
8 the purpose of this to provide guidance solely for the
9 Vogtle Unit 1, shutdown PRA?

10 MR. WOOD: Well, I think we had hoped
11 there would be some generic conclusions we could take
12 away from it. But we couldn't, it wasn't practical to
13 perform such a detailed structured approach without an
14 example problem. So, we did have the specific
15 information from the plant to focus on.

16 CHAIR STETKAR: Part of my concern is the
17 way the report is written. It genericizes a lot of
18 stuff, such that if I'm going to do a low power and
19 shutdown PRA, and I'm a member of the industry, I now
20 have an NRC approved prioritization for my low power
21 and shutdown PRA. That's the way I read a lot of the
22 conclusions of this.

23 And in fact, your slide here does not say,
24 apply the PIRT to the Vogtle Unit 1, shutdown PRA? It
25 says, to low power and shutdown PRA modeling

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1 priorities.

2 MR. WOOD: All right --

3 CHAIR STETKAR: So this is now, this
4 report is now the NRC approved scope for anyone who
5 wants to do low power and shutdown PRA.

6 MR. WOOD: Okay.

7 CHAIR STETKAR: And people will pick it up
8 and use it that way, guaranteed.

9 MR. KURITZKY: Right, so there's, as we've
10 discussed in many previous meetings, there's a lot of
11 aspects of this study that are ripe for misuse. And
12 we're going to do our best to try and minimize it, but
13 we recognize it. That people will do what people will
14 do.

15 So, the point is though, in this
16 particular aspect, we were looking to do, as Jeff
17 mentioned. We didn't have the resource to do a full
18 generic low power shutdown PIRT that would address all
19 PRA generic --

20 CHAIR STETKAR: Nor should you.

21 MR. KURITZKY: Right. But the focus was,
22 the idea was that we were doing it more in a somewhat
23 generic, with generic ideals, but using as Jeff said,
24 a specific example as a reference site.

25 And so it's not meant to be focused

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1 specifically on that site except to the extent that
2 that was the information we had available. So, the
3 idea is that knowing the aspects of that referenced
4 site, the reader has to determine whether this would
5 also apply to theirs.

6 Or the fact that, as we've discussed many
7 times before, there's many different maintenance
8 practices, shutdown practices, different
9 configurations, and so just because we've done it for
10 this site doesn't mean that it applies to your site.

11 I think we actually make those caveats show up. I
12 think it reads low power shutdown, but I'm --

13 CHAIR STETKAR: You know a few places, but
14 at the beginning and the end, beginning like,
15 Executive Summary, it's not as explicit as that.

16 MEMBER BLEY: And I'm --

17 CHAIR STETKAR: Nor does this slide lead
18 me to a lot of confidence that it ought to be
19 restricted to that. Because there are a lot of people
20 who don't want to do very much in low power and
21 shutdown. And the more excuses that they can get for
22 not doing things, they will use those excuses.

23 And this, we've said it before, this Level
24 3 PRA project will be used by folks, both outside of
25 the Agency and within the NRC for -- you know, NUREG

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1 1150 serves us as an example for a couple of decades
2 as the NRC's approved and accepted way to do things.

3 And I keep reemphasizing that, that you
4 need to be very, very aware of that. And anything
5 that is very specific to this particular unit needs to
6 be very, very clear.

7 MEMBER BLEY: I certainly agree with
8 John's comment. On the other hand, there's very
9 little in what I read here, and what I know about the
10 experts who provided their judgements to tell me this
11 is very focused on Vogtle.

12 CHAIR STETKAR: I'll get more into that, I
13 have other questions about that later. But I wanted
14 to get kind of the high level stuff, especially when I
15 saw the intro to this slide.

16 MEMBER BLEY: And in fact the kind of
17 paired comparisons they're asked to look at, such as
18 for example, the contribution of seismic compared to
19 loss of heat removal, which is most important. You'd
20 think the PRA to be able to answer that, so the only
21 way that people could answer that is from their
22 experience with other PRAs, which is very generic and
23 not specific at all to Vogtle.

24 So, there's two sides to the issue. And
25 both of them are uncomfortable.

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1 MR. WOOD: Thanks for coming. So, I just
2 want mention some of the other motivations for the
3 project were to focus on our exercising our expert
4 judgment process.

5 At the beginning of the Level 3 PRA
6 project we had some communications with the
7 Commission. And there was a commitment to pilot some
8 draft guidance on using expert judgment. And this
9 actually led to the staff, NRC staff writing a white
10 paper on the implementation of expert judgment.

11 So, this project relies on that white
12 paper, as well as some other past experience using
13 expert judgment. And also, this particular project we
14 wanted to exercise this analytical hierarchy process.

15 NRC hadn't sponsored a expert elicitation that used
16 that specific application before.

17 And finally, we also wanted to focus on
18 documenting the process. So, if someone wanted to
19 replicate this expert elicitation process, and have
20 enough detail and information to pick it up and
21 replicate it to their specific application.

22 So, some of the outcomes of this project.
23 There's, they fall into three broad areas. And I'm
24 just going to highlight them quickly. Garill's going
25 to talk about them in more detail.

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1 The primary outcome of the PIRT was a
2 ranking of the low power shutdown plant operating
3 state priorities. And we already discussed this quite
4 a bit. There's no direct tie back to the Level 3 PRA
5 project modeling. So, we did not use this PIRT to say
6 we can eliminate things. That was not done with this
7 project.

8 And just due to the timing of when the
9 PIRT was performed, and the schedule of the model
10 development, we really didn't have opportunity to
11 change our modeling with these results became
12 available.

13 The other area that came out of this
14 project was this brainstorming session. And we had
15 this collection of experts together. They brought a
16 lot of thoughts and observations to the table.

17 Some of these issues were not directly
18 related to the PIRT process. But they were valuable
19 insights from a good group of experts. So, those are
20 captured in the report.

21 And lastly, we have the draft NUREG report
22 now. It's good documentation of how this process was
23 carried out. And that really met our last objective
24 for the project. So, with that I'm going to turn it
25 over to --

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1 MEMBER REMPE: So --

2 MR. WOOD: Yes.

3 MEMBER REMPE: Maybe I'm missing
4 something. But I kind of mentioned earlier about what
5 you're going to do with the results. And you said,
6 well, we issued this NUREG.

7 But I'm wondering, are you planning to use
8 the results to look at the results of the PIRT, and
9 the results of the lower power shutdown PRA
10 evaluations and say, yes, the experts were right on
11 this?

12 And the, I mean, I didn't see that
13 discussed. Maybe I missed it. There was a lot of
14 material we were supposed to read. But are you going
15 to try and compare the PIRT results with the actual
16 analysis results?

17 I mean, you, some, you've kind of hedged
18 your bets. Because you had this preliminary group
19 that helped you focus things. But are you going to do
20 that cross comparison?

21 MR. WOOD: We haven't done it in any
22 formal way or documented way. But we have looked at
23 the results.

24 MEMBER REMPE: Well, it would be good to
25 know. I mean, are PIRTS worthwhile? Is it, you know,

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1 I mean, it would be a good thing to try and do
2 something that way, since you've spent the money.

3 And that's what I was trying to get to get
4 to. And I mentioned that earlier. And I thought,
5 well, maybe I've missed something. But I didn't see
6 it.

7 And so, I'm thinking from your response
8 now, no, you've not done that. And, you know, we've
9 been doing these PIRTs for a long time. And it might
10 be a good thing to try and do.

11 MR. KURITZKY: So, Dr. Rempe, let me
12 apologize. Because I didn't, I was, probably misled
13 you when I responded before. As Jeff said, we've done
14 this informal. We had not intended to do a
15 documentation of it, to say, I don't really see that
16 the results of our study can be used to pass judgment
17 on the validity of the PIRT.

18 Like you said, PIRTs have been, we've been
19 using PIRTs in many areas in AC for a long time. And
20 there are various objectives. And they've had
21 various, I'm sure various levels of success in meeting
22 their objectives.

23 As you know, there's a lot of uncertainty
24 associated with relying on experts. And there's a lot
25 of uncertainty. I don't really know, I mean, unless

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1 you, unless we knew exactly what in real world terms
2 would be the most important things for a lower power
3 shutdown, in this case a low power shutdown theory.

4 And I'd say, okay, well did the PIRT
5 identify those things? There's no way to really
6 validate it. It's more the other way around. It's
7 more like, here's what the PIRT came up with. We
8 didn't have that information when we decided what to
9 look at.

10 Did what we do match what the PIRT thought
11 would be important? That's kind of more what we were
12 looking at. The way you're talking about it, to
13 validate the PIRT as an approach, that would certainly
14 be beyond us.

15 And I don't think looking at a specific
16 example like our application would, could give you
17 that kind of insight.

18 MEMBER CORRADINI: So, say the last part
19 again. So, you want to reflect on, you said you want
20 to do it in one direction, but not the other
21 direction? Because I think Joy's point is a fair one
22 to consider. So, which direction are you going to
23 reflect on to --

24 MR. KURITZKY: We were looking to see
25 whether or not the results of the PIRT, for lack of a

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1 better term, validate what we did in our project. Not
2 the other way around.

3 MEMBER CORRADINI: The judgments you made
4 in your project?

5 MR. KURITZKY: Right. Exactly.

6 MEMBER REMPE: And part of that was
7 because you had the pre-evaluation. So, you kind of,
8 hopefully you would have gotten it right.

9 MR. KURITZKY: Right.

10 MEMBER REMPE: But if there were anything
11 different that came out of the PIRT that you missed in
12 your analysis, those kind of comments might be
13 worthwhile in one of these two documents. Just tie
14 them together, and have them interact some way.

15 I don't care which way you do it. But it
16 just seems like some discussion along those lines
17 ought to be, you know, evaluations should be done and
18 documented.

19 MR. KURITZKY: Yes. And that's a very
20 valid point. So, that's for, right now we're doing
21 the Phase 1. This could be the Phase 1 low power
22 shutdown report. So, as part of the Phase 2, that's
23 the kind of thing, and that's the kind of input we
24 want. And that's something we'll address under Phase
25 2, is to make sure that we --

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1 MEMBER REMPE: Okay. That's where --
2 MR. KURITZKY: -- document it.
3 MEMBER REMPE: -- I was trying to go with
4 it.

5 MR. KURITZKY: Yes.

6 MEMBER REMPE: So, thank you.

7 MR. KURITZKY: No, thank you.

8 MEMBER BLEY: I'd offer one more little
9 comment, if I may. I've already said this. Usually
10 PIRTs are focused on what the name says, Phenomena
11 Identification and Ranking.

12 This one's focused on structure of the PRA
13 model, and contributions from different aspects of the
14 PRA model. It's essentially an expert elicitation
15 PRA, without all of the details that go into the PRA.
16 So, it's a very different critter than most PIRTs
17 we've seen.

18 MEMBER CORRADINI: It's not phenomena.
19 It's operation.

20 MEMBER BLEY: It's an operation and risk
21 contributions.

22 MR. KURITZKY: Right.

23 CHAIR STETKAR: You're asking people to do
24 little mini risk assessments.

25 MEMBER BLEY: In their heads.

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1 CHAIR STETKAR: In their heads. Based on
2 their experience.

3 MEMBER CORRADINI: Exactly.

4 MR. KURITZKY: And pair --

5 MEMBER BLEY: You're shaking your head.
6 And I think you're -- Not that I'd object to you
7 saying, we did it in our heads earlier. And now these
8 guys did it in their heads. And we kind of agree or
9 disagree. But I think Joy's point's a good one. If
10 you're going to do something like this, I just
11 question the value of doing an in your head PRA.

12 CHAIR STETKAR: Jeff, I want to put you on
13 the spot. And you can bail if you want to. The last
14 bullet on your slide said, detailed documentation.
15 That's for the elicitation process. And application
16 of the AHP.

17 I've not read the white paper. I've
18 carried on the airplane twice now. And I hope to read
19 it on my way back home from this meeting. We, our
20 subcommittee has not seen anything on the staff's
21 white paper on expert elicitation.

22 The subcommittee has now seen this PIRT
23 exercise for research. What's your conclusion? Is
24 the staff going to endorse using this AHP methodology
25 going forward for expert elicitation?

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1 MR. KURITZKY: Okay. So, that's something
2 that I don't think Jeff is in a position to answer.
3 Even I am not in a position to answer.

4 CHAIR STETKAR: I told you you could bail.
5 I just wanted to get it on the record --

6 MR. KURITZKY: We're availing ourselves of
7 that --

8 CHAIR STETKAR: -- for the meeting today.
9 What I'd suggest is that, because this expert
10 elicitation, more structured, let's say quantitative
11 process for developing priorities through a PIRT, has
12 broader implications than just this study.

13 And I mean, I think that was part of the
14 reason for doing this, to address the other SRM on use
15 of expert elicitation. And perhaps concerns in the
16 past about consistency in the way PIRTS were performed
17 and, you know, things like that.

18 I think it would benefit certainly our
19 subcommittee at some opportune time. And I don't know
20 who would be the lead. Maybe nobody sitting at the
21 table today. But to get a briefing on the white
22 paper, and where the staff is headed with their --

23 I'm assuming it's under research. Where
24 research is headed in this whole area of use of expert
25 elicitation, development of a more formalized method,

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1 if you will, for either expert elicitation in a
2 general sense, or performance of a PIRT in a focused
3 type of that expert elicitation.

4 MR. KURITZKY: So, just a couple of items.

5 You're correct. No one at this table here is
6 prepared, is the right people to answer that. The
7 closest we would have had would be Jing Xing, who was
8 going to be here. Unfortunately she had a family
9 issue, and wasn't able to come in today.

10 So, but more, I do want to mention that,
11 well, the white paper, I think Jing was the author,
12 the main author for that.

13 MEMBER BLEY: Jing and Stephanie Morrow.

14 MR. KURITZKY: Yes. Okay, right. So, the
15 reason that didn't get carried out into more formal
16 documentation is because Project Aim killed that work,
17 even though it was under the SRM. But Project Aim
18 wrapped it up.

19 So, there is actually a NUREG that's in
20 the production queue, out of the Division of
21 Engineering and Research, that is an update to the
22 SSHAC, or SHAC approach. So, that, I don't know
23 enough to say, that's now the leading car in the
24 train, so to speak. But that one at least is coming
25 out as a NUREG. So --

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1 MEMBER BLEY: We actually had, it wasn't a
2 full briefing. But we discussed it in one of our
3 subcommittee --

4 CHAIR STETKAR: This is a new one that's
5 coming out.

6 MEMBER BLEY: Oh. Separate from the one
7 that -- Oh. Okay. That's pretty close proximity.
8 But, okay. Well, I think --

9 MR. KURITZKY: Maybe it was just a draft.
10 Now it's final. I don't know. Which I don't know
11 what --

12 MEMBER BLEY: It was the one Annie and --

13 CHAIR STETKAR: No, this is after that.

14 MEMBER BLEY: Okay.

15 CHAIR STETKAR: This is the one that --

16 MEMBER BLEY: Annie's gone. But the guy
17 who was her co-author on the previous one --

18 CHAIR STETKAR: Okay. Maybe we're talking
19 about the same thing.

20 MEMBER BLEY: Anyway --

21 CHAIR STETKAR: We're still looking
22 forward to seeing that --

23 MEMBER BLEY: Anyway, that's more complete
24 than this one.

25 CHAIR STETKAR: But that's more, that's

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1 not focused on PIRT. That's more SSHAC-ish.

2 MR. KURITZKY: Right. Right, right. But
3 I just know that's another, that's the only activity
4 that still is going forward. Because Project Aim
5 nipped the other one in the bud. So -

6 MEMBER BLEY: So, is the white paper here?

7 CHAIR STETKAR: Yes.

8 (Simultaneous speaking.)

9 MEMBER BLEY: --- the white paper is SSHAC-
10 ish?

11 CHAIR STETKAR: Yes. I haven't read it.
12 But I've skimmed it enough to know that.

13 MR. SHORT: So, let me --

14 CHAIR STETKAR: So, that's what, the
15 reason I brought it up here is that in part of the
16 PIRT report someplace, I made a note of it. It says,
17 well, PNNL was going to prepare some other report,
18 apparently to try to provide their insights for use of
19 AHP, I guess.

20 And I didn't, it wasn't clear to me how
21 all of this is going to come together. Or whether
22 this PIRT report is going to be simply, Yes, we did a
23 PIRT exercise, and here it is. And not influence
24 anything more in terms of general guidance in the NRC,
25 or anything, you know. It's --

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1 MR. SHORT: So, let me answer. Maybe I
2 can kind of answer that question. I'm not sure where
3 you're specifically referring to in the report. But
4 our --

5 MEMBER CORRADINI: Is the green light on?

6 MR. SHORT: Yes, it's on.

7 MEMBER CORRADINI: Okay.

8 MR. SHORT: Oh, you're not hearing? Okay.
9 But part of our task when we were tasked with doing
10 this was the, we had done this expert elicitation of
11 IS LOCA, which we talked about a couple of years ago,
12 I think, before this group, which was one of the
13 pilots that's talked about in the white paper on
14 expert elicitation.

15 One of, part of our scope, originally part
16 of our scope was we were supposed to be piloting also
17 a PIRT process that would be, go into this NUREG
18 report that ultimately the NRC was going to be
19 producing on expert elicitation process.

20 And apparently it's, which just got cut by
21 the Aim I guess. So maybe, I think that might be what
22 we're, what we may be referring to, is that it was
23 supposed to be laying out a formalized PIRT kind of
24 process. Not necessarily AHP, although that's what we
25 used as part of the, for our PIRT process. But, so

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1 that may have been what you saw.

2 CHAIR STETKAR: What I saw was an Appendix
3 A.

4 MR. SHORT: Yes. Yes. That's right.

5 Because Appendix A --

6 CHAIR STETKAR: Okay.

7 MR. SHORT: -- was our scope.

8 CHAIR STETKAR: Yes.

9 MR. SHORT: Okay.

10 CHAIR STETKAR: And there's a concluding
11 thing in some paragraph there that says, PNNL staff
12 are currently developing this process, and have
13 submitted the draft to the NRC for comment.

14 Now, this process is process. It isn't
15 this particular PIRT report. I got the impression
16 that there was kind of a PNNL report on the process.
17 And then an NRC staff white paper. And that somehow,
18 somewhere, somebody was going to merge those into a,
19 you know, an expert elicitation process going forward
20 on --

21 MR. SHORT: That was my understanding of
22 what --

23 CHAIR STETKAR: I'm not necessarily
24 hearing that.

25 MR. SHORT: -- the original plan was going

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1 to be. Yes. And maybe it's been cut by the Aim
2 process.

3 CHAIR STETKAR: Anyway, if the white
4 paper, if the incarnation of the white paper is the
5 new SSHAC-ish NUREG, then we'll certainly be
6 interested in seeing that. And now, Mike.

7 MR. CHEOCK: So, let me try to address
8 this question in a higher level. So, the Office of
9 Research, and in my division in particular, the
10 Division of Risk Analysis, we are identifying short
11 term, long term, and medium term projects past that we
12 need to look at.

13 And potentially, once we identify these
14 projects we have to plot it out, you know, define it a
15 little better, and the prioritize it, prioritize these
16 projects according to our prioritization scheme.

17 So the, we have noticed that there's a lot
18 of recent projects, let's say, that involves the use
19 of expert elicitations or PIRTs. For example, you
20 heard about the control room abandonment project that
21 used such a thing. And we talked about the fire
22 testing for the heat Phase 2, for example. And we're
23 talking about it now in Level 3 in several HRA type
24 projects.

25 So, one of the projects that we are now

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1 trying to define is, should we be looking at the PIRTS
2 of expert elicitations? And should we better define
3 these processes? And again, we will have to better
4 define these processes.

5 And then we will have to prioritize it,
6 like in accordance to our prioritization scheme. And
7 we will, depending on how the, how it's prioritized,
8 we will indeed look further into carrying out a
9 project like this.

10 MR. WOOD: Steve, why don't you go ahead.

11 MR. SHORT: All right. Kind of let me go,
12 I'm going to kind of give you an overview of the
13 project, the PNNL, and the project team. The scope of
14 work that we were asked to do is in Appendix A. That
15 reflects the scope of work we were asked to perform on
16 this.

17 The team we assembled for that was Garill
18 Coles, sitting next to me. He'll be doing most of the
19 presentation. He, we defined, he really is a project,
20 the principal investigator. But he acted as the lead
21 technical integrator on this project.

22 I'm, I was, I'm the project manager,
23 overall project manager. And I supported the project
24 as kind of technical integrator, in a technical
25 integrator kind of role.

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1 We also had Amanda White, who did the data
2 analysis. And so, which Garill will talk about in a
3 little bit. And Mike Toyooka, who kind of assembled
4 the report.

5 One of the, I wanted to respond to a
6 couple comments that were made previously, in that the
7 report that you have, the NUREG report you have is,
8 has been way, has been significantly watered down, in
9 that it's removed a lot of proprietary information
10 related to Vogtle that was used to develop the, used
11 in the PIRT process.

12 And so, that may be some of your, answer
13 some of your questions about why there isn't more
14 details about some of the specific information that
15 was used in the PIRT process.

16 MEMBER CORRADINI: Is there a proprietary
17 version you've given to staff?

18 MR. SHORT: We do have a PNNL report that
19 we've provided, yes, that's much more detailed.

20 MR. KURITZKY: Yes. The contract report
21 that I mentioned earlier has been available.

22 MEMBER CORRADINI: But we don't --

23 MR. KURITZKY: It's only that one.

24 MEMBER CORRADINI: But we don't have that.

25 MEMBER BLEY: At least, we weren't

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1 provided that.

2 MR. SHORT: I don't think we ever, no, I
3 don't think we ever presented that to --

4 CHAIR STETKAR: No. We weren't, we didn't
5 get it, through whatever channel we get stuff.

6 MR. SHORT: Right. Right. It's a fairly
7 expansive report. Because it well documents the
8 entire process we went through. So, that's a --

9 CHAIR STETKAR: Steve, I don't want to go
10 into details of proprietary information. But one
11 question that kind of permeates my continence here,
12 that maybe I can get out of the way.

13 Were the experts provided with information
14 about the, what I call maintenance configurations, and
15 the types of operation and testing that's done in each
16 plant operating state at Vogtle?

17 MR. SHORT: Yes, they were.

18 CHAIR STETKAR: In a way that they can
19 understand it, which is not just a regurgitation of an
20 outage plan?

21 MR. SHORT: What they were provided were
22 main, were the outage procedures.

23 CHAIR STETKAR: No. That's not what I'm
24 asking about.

25 MR. SHORT: So --

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1 CHAIR STETKAR: So, that's --

2 MR. SHORT: And then we talked about
3 specific configurations by plant operating state,
4 based on what was available.

5 CHAIR STETKAR: No. That's not what I'm
6 asking for either. What I'm asking for is, if I'm
7 doing a risk assessment I need three fundamental
8 pieces of information.

9 I need what is operating in each plant
10 operating state. In other words, how many trains of
11 RHR is running? How many trains of cooling water is
12 running? All that kind of stuff.

13 I need to know, based on its historical
14 outage management at that plant, in each plant
15 operating state what is removed of service, tagged
16 out, apart and pieces on the floor. I can't use it.

17 And I need to know what types of testing
18 are done in each plant operating state. So that I
19 have with the combination of operating evolutions and
20 testing, I can understand vulnerabilities to things
21 like, gee, if I'm going to do a Chernobyl type test in
22 this particular plant operating state, it might not be
23 a good day. I use that as, you know, a dramatic
24 example.

25 If the experts were not provided the

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1 latter two pieces of information, that matrix that
2 maps what is apart in pieces on the floor in each
3 plant operating state, and what --

4 MEMBER BLEY: Over time.

5 CHAIR STETKAR: Over time. So that I can
6 look at the plant operating states and see this
7 profile, if you will, of what's not there, and the
8 types of activities that are done. It's very, very
9 difficult for them to make judgments about things
10 like, whatever terms you use, very available,
11 available, not very available. So, that's what I'm
12 asking.

13 And I don't want to go into, you know,
14 that's, so far I've stayed away from proprietary
15 stuff, because I don't particularly care, for this
16 question, how Vogtle manages their outage. I do care
17 for the results of this PIRT.

18 MR. SHORT: So, let me just answer that.
19 And Darill I think will go into a little bit more
20 detail. But we had a number of outage reports over
21 several outages that talked about what was, what kind
22 of maintenance and activities were done during several
23 previous outages.

24 CHAIR STETKAR: Right.

25 MR. SHORT: Okay. And then we had a plant

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1 specific person who was an outage manager, or who,
2 operations guy, who told us, basically relayed if we
3 had specific questions that weren't in the
4 documentation, about what kinds of systems, what
5 systems are operating during those particular outage
6 states, and those kind of things. So --

7 CHAIR STETKAR: You're not answering, I
8 think you've answered my question. The answer is, no,
9 you didn't provide the experts the kind of information
10 I'm looking at. Because in my experience you can't
11 look at five outage records and get the picture of
12 what's available and not. You have to have --

13 MR. SHORT: We can't --

14 CHAIR STETKAR: -- somebody prepare that
15 information for you --

16 MEMBER BLEY: Yes.

17 CHAIR STETKAR: -- to show you a matrix
18 that in plant operating state, beginning in plant
19 operating state, I don't care, whatever it is, three,
20 through plant operating state, you know, 11, I never
21 have any of the safety injection equipment. And maybe
22 I only have one train of charging.

23 MR. COLES: Well, I think we --

24 CHAIR STETKAR: And I need to see that. I
25 don't, and I can't distill it myself looking at outage

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1 records. Because you're asking me to look at so many
2 different parameters, and combinations of so many
3 things, that there's only so much I can look at.

4 I can't get it by asking the operations
5 experts, what's normally running? Because he'll tell
6 me what's normally running. He won't tell me that, oh
7 yes, 20 percent of the time we take the stuff out
8 completely.

9 MR. COLES: We did have one really basic,
10 fundamental document from the plant.

11 CHAIR STETKAR: Okay.

12 MR. COLES: And it was, the document
13 defined the plant operating states. And in that
14 document we defined the minimum set of equipment that
15 would be available. For example, you know, when
16 you're on one train of RHR, when we are on two, when
17 you only have the steam generator. So, part of that
18 that you're getting at was there, I think.

19 CHAIR STETKAR: You're talking about what
20 I would call the success path. What is --

21 MR. COLES: That's exactly right.

22 CHAIR STETKAR: -- normally used. What
23 I'm interested in is, in which plant operating states
24 is the whole rest of the plant apart in pieces on the
25 floor, such that it cannot be used?

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1 MR. COLES: So, I was going to address
2 that second part.

3 CHAIR STETKAR: Okay.

4 MR. COLES: I was going to tell you what
5 we did have. And then a part that we perhaps didn't
6 have as explicitly is, I think we had an expert on the
7 team who was an outage manager.

8 So, to the extent that we can generalize
9 the sorts of things that happen during outages at
10 different times. For example, you know, the pipes
11 numbers. Some percentage of those are removed at
12 certain plant operating states. So, it was that kind
13 of general information that --

14 CHAIR STETKAR: Yes.

15 MR. COLES: -- we tried to --

16 CHAIR STETKAR: What I'm looking at is, at
17 a particular plant, for example, that shall remain
18 unnamed, they always cleaned their intake canals
19 during an outage.

20 And they had two intake canals. They
21 always cleaned one in the beginning of the outage.
22 They always cleaned in the end of the outage. And
23 that basically halved their availability of cooling
24 water. That was something they always did.

25 They always had cooling water running, the

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1 bare minimum that they needed for the systems that
2 were operating. But if things went belly up they
3 didn't have that other stuff available. Now, that
4 would influence my judgment, for example, in plant
5 operating states, when those intakes were in
6 maintenance.

7 Loss of residual heat removal, loss of
8 service water, those types of transient initiating
9 events, if you want to call them that, would be
10 relatively more important in those plant operating
11 states where I only had half the cooling water supply.

12 And it was the only thing available, because it was
13 the only thing running. That's the kind of
14 information that I'm asking about. And I'm not
15 hearing that it was --

16 MR. SHORT: Well, the operator from Vogtle
17 would have had that information.

18 CHAIR STETKAR: If he has --

19 MR. SHORT: I don't see how that would
20 have been written down in any specific plan.

21 CHAIR STETKAR: It is if you prepare the
22 information for a PRA. Now, I'm hoping that Alan has
23 that information. Because it's a vital element of a
24 shutdown PRA. If they don't have it, there's bigger
25 questions about the shutdown PRA than what we're going

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1 to discuss on this PIRT.

2 I'm trying to understand that if I were
3 asked to be an expert on your team, I would be asking
4 those questions. If your experts didn't ask those
5 questions, if they only asked, well, what is normally
6 running in this plant operating state, they could
7 inadvertently skew their responses about relative
8 priorities, because of their assumptions about what is
9 available in the background. You know, yes, I can use
10 these other systems for makeup, because I don't know
11 that they're not available.

12 MR. SHORT: Well, we had the plant person
13 there. And I don't know that I can fully answer your
14 question. But we had the plant person there who's
15 very familiar with plant outages, and what systems are
16 in place, and what systems are not on a general basis.

17 And he also had historical experience about past, you
18 know, unique things about what was done in previous,
19 past outages.

20 CHAIR STETKAR: Okay.

21 MR. SHORT: That was all, but none of that
22 was written down. That was just --

23 CHAIR STETKAR: Yes.

24 MR. SHORT: -- discussed --

25 CHAIR STETKAR: Yes, I know that.

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1 MR. SHORT: -- during our --

2 CHAIR STETKAR: Yes, I got it.

3 MR. SHORT: -- discussions.

4 CHAIR STETKAR: I got it.

5 MR. COLES: And for us, actually we
6 identified the specific uncertainty of our PIRT
7 process. Because remember, we defined these POS as
8 sort of static states, which they are not, and so on.

9 CHAIR STETKAR: But that's fine structure
10 detail. I get the fact, you know, I can get my head
11 around, as an operations guy, the fact that, yes, I'm
12 going to model the plant in a particular pressure
13 temperature of threshold time in POS, you know, seven.

14 I kind of get that, and the fact that that's not a
15 static thing. But I can accept that.

16 But if half of my electrical system is
17 always out of service in POS, from the middle of POS-6
18 through the middle of POS-8, that's important for me
19 to understand.

20 MR. SHORT: Or if you had backups, if you
21 had other backup systems available.

22 CHAIR STETKAR: Or if I had other backup.
23 Because the way they do business they always bring
24 in, you know, the save all diesel, and have it --

25 MR. SHORT: Right.

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1 CHAIR STETKAR: -- you know, ready to
2 connect. That's really important for me to
3 understand.

4 MR. SHORT: Right. We did have those
5 kinds of discussions. Some of those things are
6 documented in, I would say in the specific expert's
7 reasoning, why they read something the way they did.
8 That didn't make it into this particular report
9 because of the proprietary --

10 CHAIR STETKAR: Yes, yes. That's, and
11 that's the reason I hate belaboring this. But I
12 wanted to get it out in the front. So, I kind of have
13 the frames of a few of the questions that I'm going to
14 ask later on.

15 MR. SHORT: Okay.

16 CHAIR STETKAR: So, thanks.

17 MEMBER BLEY: But since Steve just
18 mentioned that, in this sanitized report we got to
19 read you say you gave the experts an opportunity, if
20 they wanted to, to justify their rankings. Is there a
21 reason you didn't tell them to do that? Or did they
22 do it quite often in the report we didn't see?

23 MR. COLES: Well, there was a lot of,
24 there are a lot of entries to make. And we told them
25 to do it to the extent that they could support their

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1 entries. So, a lot of it was repetitious.

2 MEMBER BLEY: Okay. The way I read it, it
3 sounds like it was purely your option.

4 MR. SHORT: Most of them put something in
5 there.

6 MR. COLES: Yes. But not in every field.

7 They didn't necessarily document all their decision
8 process.

9 MR. SHORT: One guy did.

10 MR. COLES: Yes, that's true.

11 MR. SHORT: One guy used every field. So,
12 it was kind of dependent upon the expert. Are we
13 ready to go on? So, before I turn it over to Garill,
14 I just wanted to say that we did try to, we did follow
15 this, the white paper on expert elicitation fairly
16 well.

17 I'd say there were a couple of areas, you
18 know, there's areas that we didn't follow it to the
19 tee. There's a ten step process in here for how you
20 do expert elicitation. I think it can kind of
21 genericized for PIRT. And so, we kind of followed
22 those.

23 I would say that, you know, there's, one
24 aspect of it was risk identification and mitigation,
25 and checkpoints. You know, we probably didn't really

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1 follow that to the tee in there. But for the most
2 part I think we kind of followed the general process.

3 We deviated a little bit from the Workshop
4 123 format, which comes out of the SSHAC. Garill will
5 get into that in a little bit more detail, about what
6 the process, overall process.

7 And I do want to say that we kind of, we
8 also did start with NUREG-1449, which was the early
9 state, not state shutdown, but low power shutdown
10 NUREG that was put together back in 1993. We kind of
11 looked at that, and used that as a starting point for
12 helping the experts know what was most recently
13 produced by our seeing this topic area.

14 And with that I'll turn it over to Garill
15 to start through. And I just want to comment. I
16 think we're running way behind schedule maybe.

17 CHAIR STETKAR: Don't worry. We'll manage
18 the schedule.

19 MR. COLES: Okay. All right. So just --

20 CHAIR STETKAR: You didn't look at any
21 other low power and shutdown studies that have been
22 overseas, since a lot of people in Europe --

23 MR. SHORT: We didn't --

24 CHAIR STETKAR: -- have done a heck of a
25 lot more work on this than --

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1 MR. SHORT: We did --

2 CHAIR STETKAR: -- people in the U.S.?

3 MR. SHORT: -- not as part, formally as
4 part of our analysis.

5 CHAIR STETKAR: Okay.

6 MR. SHORT: Now, we do know that some of
7 the members on the panel have worked on some of those.
8 And so, okay.

9 CHAIR STETKAR: Okay.

10 MR. COLES: Yes. We only got what was
11 publicly available.

12 MR. SHORT: Right.

13 MR. COLES: Yes. So, there's 30 slides.
14 And I know you're going to help me manage the time.
15 So, I'll just let you know ahead there's about 30
16 slides.

17 So, what is PIRT? We had a little bit of
18 discussion about that. A lot of literature refers to
19 PIRTs as Phenomena Identification Ranking Table.
20 Other references refer to it as Phenomena
21 Identification Ranking Technique. This is the wording
22 we chose, because our PIRT was not entirely a table
23 driven process.

24 And then we liked this definition, this
25 more general definition from literature, a systematic

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1 way to gather information from experts about
2 identification of plant systems, processes, phenomena,
3 and rank them according to some decision that needs to
4 be made.

5 We do acknowledge PIRTs have been
6 successfully applied to several applications by NRC.
7 And those, in those, like for example, this series on
8 6742. Those were phenomena related to specific kinds
9 of accidents for reactors containing high burnup fuel.
10 And they were kind of tabled during the processes.
11 Here we use PIRT to identify important elements of low
12 power shutdown, PRA.

13 This slide shows our expert panel members,
14 seven experts from the nuclear power industry and NRC.
15 The five PRA experts had 30 to 40 years experience.
16 You probably recognize most of those names.

17 In, across the board low power shutdown,
18 internal events, flooding, fire, seismic. And I have
19 seen some of those names on seismic PRAs. So, we know
20 that we have some seismic experience in that group.

21 And as Steve said, our operations expert,
22 his experience was with the reference plant. So, he
23 had 30 years of operating experience. And so, he
24 could go find things in specific operating or
25 maintenance procedures when we had questions. And --

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1 MR. SHORT: So, let me just kind of
2 interrupt here. So, I think there was a question
3 earlier about whether we had Level 2 expertise. Marie
4 Pohida and Jeff Mitman are the people we had on the
5 panel that we, that had the Level 2 expertise.

6 (Off microphone comment)

7 MR. SHORT: Okay. We will readily admit
8 that we did not have a Level 3 in the process.

9 MEMBER BLEY: Yes. And I think the kind
10 of Level 2 help you had were more in structuring the
11 PRA, rather than doing severe accident detail work.
12 Although there are some here.

13 MR. COLES: Well, this slide shows our
14 participatory peer reviewers. The participatory peer
15 reviewers provided in depth process information to us,
16 after participating in the various steps of the
17 process.

18 And I'm going to say quite a bit more
19 about this in a couple of slides. But you can see
20 that Jeff and Jing Xing were our participatory peer
21 reviewers. And Jing's experience you might know is in
22 human factors and expert elicitation. And was one of
23 the authors of this white paper that we refer to.

24 The motivation for the PIRT, as we've been
25 discussing, and we ended up defining, was largely

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1 driven by the fact that to do a comprehensive
2 assessment of low power shutdown risk, you know, it's
3 challenging, given the number of plant operating
4 states, 15 to 20, and outage types, plus the different
5 kind of hazards you might want to consider.

6 The evaluation of just one plant operating
7 state is a PRA in and of itself, right. So, multiply
8 that by the times, the number of states that are --

9 MEMBER BLEY: There are some folks sitting
10 around this table who have actually done some.

11 MR. COLES: There you go. Yes.

12 MEMBER BLEY: So, you don't need to pitch
13 that too hard.

14 MR. COLES: Yes. So, the purpose then of
15 our PIRT, just to reiterate, identify the plant
16 operating states and outage types, and important
17 hazards for a plant, and rank them according to their
18 importance to low power shutdown risk, while
19 considering important influences, phenomena associated
20 with low power shutdown.

21 And we talked about the scope being
22 limited to in core. And then, to some extent we do
23 address phenomena from the point of view that was
24 sometimes identified explicitly in the evaluation
25 criteria using the PIRT. And we'll show examples of

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1 that as we move through. And also identified as
2 contributing to a low power shutdown PRA uncertainty
3 or sensitivity.

4 As has been discussed, the project
5 considered the following, there in the blue text,
6 SSHAC principles in putting together the PIRT process.

7 SSHAC, and maybe, you probably already know. But
8 it's documented in 2117. And was developed for
9 addressing probabilistic seismic hazards analysis.
10 It's considered kind of state of art process for
11 expert elicitation.

12 So, the principles I wanted to mention
13 are, following a structured process, you know,
14 obtaining a breadth of state of knowledge, in terms of
15 the experts and the information. Maintaining
16 independence between experts. But also allowing
17 controlled interaction between the experts. And then,
18 also maintaining integration, as opposed to seeking
19 consensus of judgments.

20 We had four training sessions that helped
21 us ensure the experts understood the stated problems,
22 and the process that they are about to embark in.
23 Feedback from the participatory peer reviewers who
24 monitored the elicitation process helped us create a
25 well-defined process, and one that avoided a

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1 motivational cognitive biases.

2 The participatory peer reviewers actually
3 participated in all steps of the process where we
4 interacted with the experts. This included
5 familiarization and training meetings, the individual
6 elicitations, the group elicitations.

7 And they also participated in a couple of
8 trial runs, as kind of substitute experts, before we
9 implemented the process with the expert panel. And in
10 addition, they received all the preparatory materials
11 that the expert panel members received.

12 Here's a figure that shows the high level
13 of how the PIRT process was laid out, the seven steps.

14 The first step was defining the problem statement and
15 the objectives and expectation of the PIRT, gathering
16 all the technical plant and PRA material needed for
17 the PIRT.

18 This included description of the reference
19 plant, plant operating states, plant outage types,
20 their operating procedures, and their outage reports.

21 We also gathered publicly available work on low power
22 shutdown PRAs in previous PIRTS.

23 Step 2 was putting together the
24 facilitation team and the expert panel, and
25 disseminating all of the information we gathered to

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1 the team. The information we gathered was Step 1.

2 Step 3 was holding four, a series of four
3 online familiarization and training meetings with the
4 team. So, that's us, the experts, and the
5 participatory peer reviewers.

6 The first online meeting was a project
7 overview. It included some training on motivational
8 and cognitive bias. The second was we just got the
9 details of the PIRT. The third was on, we discussed
10 the initial parameters to use in the PIRT process.

11 And the fourth meeting we discussed how
12 the elicitation form should be filled out. And during
13 this step the experts had further requests for data,
14 which we went out and got, compiled, and disseminated
15 to them.

16 The fourth step is where we solicited
17 input from the expert about the PIRT parameters we
18 should use. And we did that by email. The fifth step
19 is where we performed our online elicitations with
20 each individual panel member. And we're going to talk
21 about that more. So, I won't go into a lot of detail.

22 And we did quite a bit ahead of that,
23 those elicitation meetings. We, like I said, we had
24 the trial elicitations that we did with the
25 participatory peer reviewers. We created an

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1 instruction manual for the experts. And we also
2 developed a facilitator's guide for ourselves, to kind
3 of ensure that we walked each individual expert
4 through the process in a consistent way.

5 MEMBER SKILLMAN: Garill, may I ask a
6 question, please?

7 MR. COLES: Yes.

8 MEMBER SKILLMAN: Either Step 3 or 4 in
9 this image, you mentioned motivational bias. That
10 sounds to me like something you'd get at Parris
11 Island. What is motivational bias?

12 MR. COLES: Well, I wish I had those
13 training slides with me. But, you know, motivation
14 bias, you can be biased for, because of a desire to
15 appear like you're the expert.

16 Or you could be biased because of the
17 opinion of a colleague across the table who has a
18 particular opinion, and you respect that, you know,
19 that person.

20 There's actually a whole kind of science,
21 or set of biases that relate to, you know, how you
22 might be motivated. That's not in the interest of
23 this exercise. Because it's --

24 MEMBER SKILLMAN: That was helpful.

25 MR. COLES: Yes. Okay.

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1 MEMBER SKILLMAN: The term just kind of
2 struck me as --

3 MR. COLES: Yes.

4 MEMBER SKILLMAN: -- not something I'd be
5 familiar with. Thank you.

6 MR. COLES: You're welcome. The sixth
7 step was our face to face meeting, or what we called
8 our group meeting. We started the meeting by kind of
9 going over the results of the individual elicitations,
10 and providing some assessments to the experts. So --

11 MEMBER BLEY: Darill --

12 MR. COLES: -- what differences we saw.

13 MEMBER BLEY: Let me interrupt you a
14 second.

15 MR. COLES: Yes. Yes.

16 MEMBER BLEY: Were you the facilitator for
17 all of these? Or did you, were there others?

18 MR. COLES: I was.

19 MEMBER BLEY: So, we had that for
20 consistency across --

21 MR. COLES: Yes.

22 MEMBER BLEY: And what was your approach
23 for testing people for bias? And how did you try to
24 help them get around their biases.

25 MR. COLES: Well, one thing we did was --

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1 MEMBER BLEY: I always like to mention the
2 history of this. I always liked Robin Hogarth's early
3 paper on biases, and what they are. I thought that's
4 one of the most complete ones I've seen. But what did
5 you do to try to deal with that.

6 MR. COLES: We, well, one thing we did, as
7 I recall in our facilitators' instruction manual, is
8 we emphasized the kind of biases that we thought might
9 be more, most important for the elicitation. And we
10 kind of went over some examples of that. And we did
11 that, I think we did that consistently at the front of
12 every elicitation we did.

13 MEMBER BLEY: And along the way did you
14 spot cases where you wanted to push them a little bit,
15 and remind them of the possible biases?

16 MR. COLES: I think, well, I think we did
17 a pretty good job of that. You know, I'll have to say
18 that our participatory peer reviewer, Jing, was keenly
19 aware of the issue.

20 And by the way, she was participating in
21 all these sessions. So, she had feedback for us after
22 every session. And that's where we picked up some of
23 our examples that we would use.

24 MEMBER BLEY: She was in on the ones you
25 did?

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1 MR. SHORT: All of them.

2 MEMBER BLEY: The individual ones?

3 MR. COLES: YES.

4 MEMBER BLEY: Okay. Wow. Okay.

5 MR. SHORT: I think at least most of them.

6 MR. COLES: Yes.

7 MR. SHORT: There may have been one or two
8 she missed.

9 MR. COLES: I was going to say, but Jeff
10 was at the ones she missed.

11 MR. SHORT: Yes. Jeff was at all of them
12 I think. Now, that's not to say that we can't say
13 that it wasn't from biases that were introduced,
14 right.

15 MEMBER BLEY: There always are. And my
16 hope is the facilitator worked it --

17 MR. SHORT: Yes.

18 MEMBER BLEY: -- to try to spot them, and
19 help the experts work those out.

20 MR. SHORT: Yes.

21 MR. COLES: The group process, so that,
22 the main idea there was we gave each expert the
23 opportunity to say why he filled out the form the way
24 he did. And then the other experts had an opportunity
25 to respond to that. So, a little bit of across the

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1 table discussion.

2 And then, each expert was given the
3 opportunity if he wanted to amend or adjust the way he
4 filled out his forms. And those were sent in a week
5 or so after the group meeting. Then Step 7 is an
6 analysis of the results.

7 CHAIR STETKAR: Okay. Garill --

8 MR. COLES: Yes.

9 CHAIR STETKAR: I'm going to interrupt you
10 right now. Because we're going to switch gears here a
11 little bit --

12 MR. COLES: Okay.

13 CHAIR STETKAR: -- with this slide. So,
14 what I propose is that we take a break. And that we
15 recess until 10:35 a.m.

16 (Whereupon, the above-entitled matter went
17 off the record at 10:21 a.m. and resumed at 10:35
18 a.m.)

19 CHAIR STETKAR: Let's come back in
20 session. We are aware of time. So, don't worry.
21 We'll manage time. So, Garill. Yes. I was, you
22 know, I will use the mantra, I don't have a life, so
23 why should you? Continue.

24 MR. COLES: Thanks, John. So, on this
25 slide we wanted to, well, we noticed an early article

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1 on the PIRT process, an endorsement of something
2 called the Analytical Hierarchy Process that we
3 referred to, AHP.

4 And so, Wilson and Boyack, in an article
5 for "Nuclear Engineering and Design" -- By the way,
6 you see the word Wilson and Boyack in quite a few of
7 the NRC PIRTs. Stated that regarding PIRT, that AHP
8 is a highly recommended way to formalize the product
9 to be defensible, scrutinizable, and complete. Though
10 it requires more work.

11 And so, there was a comment made. And
12 just to be fair, there was a downside. And I'll talk
13 about our benefits. But the downside for us I think
14 was the more work part.

15 It took time to explicitly define the
16 evaluation criteria. So, that part took time. And
17 then there was really a large number of these pair-
18 wise comparisons that you had to do in order to
19 determine the weights associated with the evaluation
20 criteria.

21 And I think that it's safe to say that it
22 took more up front time for we, the facilitators and
23 technical integrators, to set up the problem, or the
24 process.

25 CHAIR STETKAR: Garill.

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1 MR. COLES: Yes.

2 CHAIR STETKAR: As you go through your
3 slides --

4 MR. COLES: Yes.

5 CHAIR STETKAR: I will tell you that I
6 studied this thing. And I cannot divine how all of
7 the numbers are put together. And I will tell you
8 that I reproduced spreadsheets --

9 MR. COLES: Yes.

10 CHAIR STETKAR: -- to try to do that. If
11 it's difficult for me to divine, it's not at all clear
12 how the experts could have understood it. Nor is it
13 clear to me how the process with the numerical values
14 that you suggested for the experts, for the
15 comparisons does not inadvertently over emphasize the
16 importance of certain elements that were being
17 evaluated.

18 So, if you could somehow, as you're going
19 through your slides, give me more confidence that the
20 process isn't inherently biased because of all of the
21 complexity, and the fact that it's not intuitively
22 obvious to the experts how their assessments, for
23 example, a seven versus a nine, are going to be
24 treated.

25 MR. COLES: Yes.

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1 CHAIR STETKAR: Okay.

2 MR. COLES: We do address that. We're
3 going to try to --

4 CHAIR STETKAR: Go on.

5 MR. COLES: Okay.

6 CHAIR STETKAR: Just keep it in the back
7 of your mind.

8 MR. COLES: All right, then.

9 MEMBER REMPE: Okay. So, we heard about
10 the pre PIRT that was done, that helped with the low
11 power shutdown PRA. And I'm just wondering, in your
12 process, and maybe I should have asked it on the prior
13 slide.

14 But the objective of this PIRT seemed to
15 kind of change as it went along, because of the
16 schedule. And how does that affect the process in how
17 the guidance was given to the panel?

18 They knew that there had already been a
19 pre PIRT. I mean, how was that treated? Was it just
20 ignored, and they were to pretend like it was going to
21 be used?

22 MR. WOOD: Well, this thing you're
23 referring to as the pre PIRT, I think was the input we
24 received from the TAG, the Technical Advisory Group.

25 MEMBER REMPE: Oh. I thought you said,

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1 well, some of the same experts thought that are on the
2 PIRT --

3 MR. WOOD: I think --

4 MEMBER REMPE: -- were also in the pre
5 PIRT.

6 MR. WOOD: There was some overlap.

7 MEMBER REMPE: So, they knew --

8 CHAIR STETKAR: Well, wait --

9 MEMBER REMPE: -- that this has already
10 been done, right?

11 CHAIR STETKAR: Let's be clear. I think
12 Jing and Jeff went through the exercise first, didn't
13 you guys? That's what my understanding was. This pre
14 PIRT you tested the spreadsheets.

15 MR. WOOD: Yes. I think we're talking
16 about different things though.

17 MEMBER BLEY: Two different pre PIRTS.

18 CHAIR STETKAR: Two different pre PIRTs?

19 MR. WOOD: Right. So, there was first the
20 input we received from the TAG, which was more focused
21 on helping the model development. Because this PIRT
22 process was coming later in the schedule.

23 MEMBER REMPE: Right.

24 MR. WOOD: And there was some overlap of
25 the members.

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1 MEMBER REMPE: Okay. It was just you and
2 Jing? It wasn't like some of the other experts?

3 MR. WOOD: No. Some of the experts.
4 There --

5 MEMBER REMPE: Fine.

6 MR. WOOD: -- was overlap in the experts.

7 MEMBER REMPE: That's what I, somehow or
8 other when I read through this I got that opinion,
9 that they were involved with -- And so, again, they
10 already knew what needed to be done was done.

11 They also, were they, it seems like they
12 might have thought their earlier input was something
13 they should hold onto, since that had gone forward.
14 And I just am kind of wondering how much that pre PIRT
15 influenced the actual PIRT?

16 MR. WOOD: Well, PNNL was not involved in
17 this activity we're calling the pre PIRT.

18 MEMBER REMPE: Okay.

19 MR. WOOD: So, they can't really speak to
20 that. We gave them the TAG input that we received.
21 So, you all have that.

22 MEMBER REMPE: But the experts, some of
23 them had an early opinion that they held onto,
24 irrespective of any training they were given for this
25 PIRT.

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1 MR. WOOD: Right.

2 MEMBER REMPE: And I'm just kind of
3 wondering if that would influence. I mean, but
4 basically you -- What were the PIRT members told of
5 the object -- how their results would be used?
6 Doesn't that sometimes affect how a PIRT's done, if
7 they know how the results are going to be used?

8 MR. WOOD: There could be some influence.
9 And maybe some of the experts kept some of their
10 initial thinking, and carried it over. We didn't
11 really address how that influenced this PIRT.

12 MEMBER REMPE: Okay. And this PIRT, were
13 they told, we're doing this, but PRA's going on down.
14 The train's already left the station. And we're just
15 doing this for general insights, or something. I
16 mean, what were they told?

17 MR. WOOD: We did tell them that.

18 MEMBER REMPE: Okay.

19 MR. WOOD: We did tell them that it was
20 not going to have a direct impact on the model
21 development.

22 MEMBER REMPE: Okay.

23 MEMBER BLEY: Garill, before you go, I
24 had, I apologize for being a couple of minutes late
25 getting back. I had wanted to ask you earlier, you

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1 talked about facilitator guidance that was prepared.
2 Is that something more than that two page checklist
3 that's in Appendix I to the report we looked at? It's
4 a page and a half. Well, it's more, this is more
5 process oriented.

6 MR. COLES: Yes. This is more process
7 oriented.

8 MEMBER BLEY: Yes. So, you did have like
9 a handbook, or guidance that you prepared, describing
10 the facilitator role?

11 MR. SHORT: Absolutely.

12 MR. COLES: Yes.

13 MEMBER BLEY: Because we never got to see
14 that. Is that something we could take a look at one
15 day? If you guys got it.

16 MR. COLES: Yes, I, is that something that
17 is -- we at the NRC haven't received, I think ---

18 MEMBER BLEY: Oh, you haven't seen it?

19 MR. COLES: I don't think --

20 MR. SHORT: Well no. Let me just look at
21 the table of contents here. Because I can't remember
22 --

23 MEMBER BLEY: Well, Appendix I is the --

24 MR. SHORT: I can't remember what's fold
25 in the --

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1 MEMBER BLEY: -- facilitator checklist.
2
3 MR. SHORT: -- in the NERD report, versus
the other report, okay. So --

4 MR. COLES: The checklist, yes, I think
5 that's primarily what we're talking about when we say
6 --

7 MEMBER BLEY: That doesn't talk about
8 bias, and any of that stuff at all.

9 MR. COLES: No. That other stuff resides
10 in other parts of the report.

11 MR. SHORT: In the presentations and the
12 discussions we had.

13 MEMBER BLEY: Okay.

14 MR. COLES: There's, the first
15 presentation --

16 MEMBER BLEY: The way you were talking
17 about it earlier I thought that was --

18 MR. SHORT: No. That Appendix I --

19 MEMBER BLEY: -- kind of a primer on how
20 to be a good --

21 MR. SHORT: -- is the checklist. Yes.

22 MEMBER BLEY: I'm sorry.

23 MR. SHORT: That appendix is the checklist
24 we used.

25 MEMBER BLEY: Okay. And that's what you

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1 were referring to?

2 MR. SHORT: Yes.

3 MEMBER BLEY: Okay.

4 MR. SHORT: Yes.

5 MR. COLES: As far as the benefits of the
6 AHP, we at PNNL, we thought there was benefit because
7 the pair-wise comparisons are not too difficult to
8 perform. And the cognitive scientists tell us that
9 comparative analysis is easier than absolute analysis.

10 So, I think that trying to make pair-wise comparison
11 sometimes, you know, that turned out to be very
12 doable.

13 CHAIR STETKAR: Garill.

14 MR. COLES: Though there were a lot of
15 them.

16 CHAIR STETKAR: Garill, one of the things
17 that I was thinking about is, and I agree with you,
18 it's a lot easier for me to make a pair-wise
19 comparison, A versus B, B versus C. The problem is
20 that, as I read through this it's in many cases not as
21 simple as you constrained it.

22 So, if I think of, for example, my
23 availability of things that put water into the reactor
24 coolant system. You characterize that under an
25 attribute of inventory control. You did not

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1 characterize it as an attribute of heat removal.

2 I, doing a PRA, characterize it for both.

3 Because I can do something called feed and boil. So
4 therefore, my availability, now I can't do a simple
5 pair-wise comparison of A versus B under each of these
6 criteria. Because you've constrained it artificially,
7 so that I can't think of that sort of triad, if you
8 will. Did you think much about that?

9 MR. COLES: Well --

10 CHAIR STETKAR: Because it's something
11 that struck me that, yes, it's easy to do pair-wise
12 comparisons, as long as you clearly define the box
13 that I'm working in. But I was concerned that perhaps
14 the box was overly constrained for the type of results
15 that you were looking for.

16 MR. COLES: I think that was a comment
17 that the experts brought up, that in a sense we're
18 kind of making them hold in their minds, when they're
19 doing this comparison, all the things they understand
20 about the uncertainties, and different configurations,
21 and the possibilities. And do that trade off when
22 they're making that comparison. So, in that sense
23 it's a difficult --

24 CHAIR STETKAR: Okay.

25 MR. COLES: We also felt that the use of

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1 explicit evaluation criteria contribute to the
2 transparency and the completeness in the way the
3 assessment was performed.

4 And then of course, the natural outcome of
5 AHP is listing of alternatives. And that was kind of
6 exactly what we were interested in, was ranking POS
7 according to risk.

8 CHAIR STETKAR: I went back and read that
9 paper that you referred to.

10 MR. COLES: Yes.

11 CHAIR STETKAR: And I was struck by the
12 notion that that paper draws, I've forgotten the
13 terminology that he uses. So, I won't try to go look
14 it up. But there's a couple of different examples
15 about how you might think about the problem.

16 And I was struck by his emphasis of the
17 numerical precision. For example, .255, .255 versus
18 .246. And, oh my God, if you look at it this way,
19 look at these differences. It strikes me as a process
20 that relies primarily on numerical precision than
21 perhaps accuracy.

22 So, are we emphasizing your process that
23 seems to be focused on large numbers of spreadsheets
24 to give us the illusion of numerically precise
25 results, when indeed there is much broader uncertainty

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1 in what people are doing overall?

2 MR. COLES: Well, yes. There's maybe --

3 CHAIR STETKAR: It's nice for people who
4 like to construct spreadsheets, and have three
5 significant figures when they compare something with
6 .255 versus .243.

7 MR. COLES: I think that's a fair comment,
8 you know, things that -- On the other hand, in some
9 cases an eval -- we determined some evaluation
10 criteria to be much more. And you'll see that in the
11 results.

12 CHAIR STETKAR: Yes, go on. Yes.

13 MR. COLES: Yes. And also, I'll just
14 mention that the staff's, Jing Xing's kind of thoughts
15 on AHP are written down in Appendix E. I don't have
16 that Appendix E in front of me. But if you want to
17 sort of understand --

18 CHAIR STETKAR: I read it.

19 MR. SHORT: Her take on it.

20 MR. COLES: You read it. Okay. So, on
21 the next slide, thanks, Alan. We're going to try to
22 provide a very, very brief explanation how AHP works,
23 with a simple example.

24 First, a hierarchy of explicit evaluation
25 criteria is developed against whatever our overarching

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1 goal is. So, if you look at that top figure, look at
2 the blue box. The blue box says, selecting the best
3 job. So, that's our goal.

4 And in this example you see the yellow
5 box. That's the criteria. So, the blue box and the
6 yellow box, when we say the hierarchy, and when Saaty
7 refers to the hierarchy, he's talking about that top
8 goal and the criteria.

9 In this case we have only one tier of,
10 there could be sub-criteria. And in our case, in our
11 PIRT there were sub-criteria. The criteria is listed
12 down in the lower orange box.

13 And for this example, remember, selecting
14 a job, they're flexibility, opportunity, security,
15 reputation, salary. And you see that the figure tries
16 to illustrate that you use the criteria to prioritize
17 the alternatives. The alternatives being the gray
18 boxes.

19 But then in the lower right hand orange
20 box you see what the alternatives are. It's working
21 for a domestic company, working for a international
22 company, working for a college or state university.

23 Now, because the evaluation criteria are
24 not created equal, I mean, we don't weight salary the
25 same as we do flexibility and opportunity. We do the

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1 pair-wise comparisons to establish what weight to put
2 on each criteria. Now, I'm going to show that in the
3 next slide. And then, on the third slide --

4 MEMBER SKILLMAN: Before you go --

5 MR. COLES: -- I'm going to --

6 MEMBER SKILLMAN: Before you go there.

7 MR. COLES: Okay.

8 MEMBER SKILLMAN: Back up. So, I look at
9 this spider diagram, and I notice that criteria 1, 2,
10 3, and 5 connect to all four alternatives. But 4 does
11 not. And so, I was saying --

12 MR. COLES: Oh.

13 MEMBER SKILLMAN: -- why doesn't 4 connect
14 to flexibility.

15 MR. COLES: I missed a line. Yes.

16 MEMBER SKILLMAN: Oh, okay.

17 MR. COLES: Yes. All right. Thank you.

18 MEMBER SKILLMAN: That takes care of that.

19 MR. COLES: That's fine.

20 MR. SHORT: Good catch.

21 MR. COLES: That's the extent of my
22 graphics skills.

23 CHAIR STETKAR: You're a very scary guy.

24 More scary than I am.

25 MR. COLES: So --

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1 MEMBER SKILLMAN: No. I thought there was
2 significance to that.

3 MR. COLES: Of course, yes.

4 MEMBER SKILLMAN: So, I said, well,
5 somehow on that specific incident alternative 1 and
6 criteria 4 don't connect for some reason. So, thank
7 you. I was just curious.

8 MR. COLES: That's supposed to be very
9 notional, yes. In this slide we show how the pair-
10 wise comparisons are made between the different
11 evaluation criteria, by assigning comparison scale
12 categories.

13 So, the actual pair-wise comparisons are
14 made in that top table, the rust colored table. And
15 you see how the evaluation criteria are both in the
16 column headers, and then in the rows, the front of
17 each row. So, you can even notice here, like --

18 CHAIR STETKAR: Garill, you have to speak
19 into the microphone for the transcript so use the
20 mouse if you want to point and just look on the screen
21 in front of you.

22 MR. COLES: Okay, so if you look for
23 example in the top left-hand cell, when we compare
24 flexibility to flexibility, of course the value is
25 one.

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1 If we go over one cell, you can see that
2 when we compare flexibility to opportunity,
3 flexibility is given much less weight than
4 opportunity.

5 But to do that, what we do is we use this
6 comparison. The best is the yellow table and you see
7 the comparison scale categories defined there.

8 And so if Criterion X is considered
9 exceptionally more important than Criterion Y, that's
10 this Comparison Category A, then the importance ratio
11 is 9, and then you assign this to Category A.

12 If Criterion X is considered strongly more
13 important than Y, then you see that the ratio is 7 and
14 you apply this Category B and so on.

15 CHAIR STETKAR: And my concern through the
16 whole process is there's no difference between a 7 and
17 9 when you finally do the numerical weights because
18 there's no difference between a 0.11 and a 0.14.

19 And saying that something is weighted
20 0.25, you in words say that is moderately less
21 important, but to me 0.25 of the weight is a pretty
22 big difference.

23 And saying that a factor of two is only
24 slightly less important to me is a pretty big
25 difference.

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1 So, what I'm concerned about is people
2 looking at the words that you use and not recognizing
3 the fact that, oh, gee, if I assess something as a B
4 versus an A and I struggle with that, it doesn't make
5 any difference because ultimately, those get
6 completely discounted in the end anyway.

7 MR. COLES: So one thing we've learned,
8 and by the way, in our process we did not show the
9 expert's importance ratio --

10 CHAIR STETKAR: Hence my concern.

11 MR. COLES: And the reason is -- Saaty
12 explains this -- not to get caught up in those ratios.

13 CHAIR STETKAR: But the ratios are what
14 finally determines all of your colored little plots.

15 MR. COLES: It's just more important that
16 you have a spread of values, and I'm not a
17 statistician but we exercised this for ourselves by
18 using different spreads. And it didn't have a huge
19 impact on the outcome.

20 What we tried to do is get the experts to
21 focus on the definition, so they did not see the
22 values. We had actually some internal discussion
23 within the facilitator/integrator NRC team about
24 whether or not --

25 CHAIR STETKAR: You say definition, you

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1 mean strongly more important, moderately more
2 important?

3 MR. COLES: Yes.

4 CHAIR STETKAR: So, if I think something
5 is strongly more important or exceptionally more
6 important, I just look at those two things and make my
7 judgments, not realizing that they don't make any
8 difference in the overall conclusions.

9 To me, I would be really upset if I was an
10 expert, not knowing that it didn't make any difference
11 or the things that you're calling --

12 MR. COLES: I don't think that's true. I
13 think you have to kind of play with these numbers.

14 CHAIR STETKAR: You do, and I did a lot of
15 this back in the '90s, not using this particular
16 methodology, and it took me about three years to get a
17 reasonable scale, testing it on a whole bunch of
18 operators from nuclear power-plants before I had
19 confidence that it wasn't inherently biased simply
20 because of the way I was presenting the textual text
21 descriptions and translating that into numbers.

22 And I always showed the operators the
23 numbers.

24 MR. COLES: We try to use the method
25 straight up as it's explained to us by the author of

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1 the method, Saaty.

2 CHAIR STETKAR: One professor in one paper
3 using his method.

4 MEMBER BLEY: There's a fairly large
5 literature debating lots of aspects and they don't all
6 settle on one side.

7 MR. COLES: So, I think the takeaway,
8 then, if you look at the top slide again, you sum up
9 those weights and you kind of get a normalized set of
10 priorities.

11 So, then in the end, you see that salary
12 is 0.31 followed by opportunity, 0.25, security, 0.23,
13 and reputation, 0.1, flexibility, 0.03. That's the
14 takeaway from that slide.

15 And the next slide, this set of tables are
16 trying to show us how we take the evaluation criteria
17 weights, how they're kind of used in sorting out the
18 priorities.

19 So, if you look at the top left table,
20 that's the grey table, you see that in the end, we're
21 going to assign a ranking category of high, medium, or
22 low.

23 But before we do that, before we can do
24 that, we fill out the blue table on the right. This
25 is called the ranking category tables and this is

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1 where the ranking categories are both defined and
2 assigned weights.

3 In this case, we've made the assignment
4 really easy; we've just said high, medium, low. And
5 we actually went through a comparalyzed comparison to
6 get weights for those categories.

7 CHAIR STETKAR: Garill, this table on the
8 right is what started me with my concerns. And I know
9 it's an actual example from one of the assessments.
10 So, this is a Gedanken experiment, somebody actually
11 did this in your report.

12 If I look at the top line on that upper
13 right-hand table, I see high to high is one, high to
14 medium is seven, and high to low is nine.

15 When I look at the final results of that,
16 it says that although I think I've distinguished
17 between high, medium, and low, I only have high and
18 not important because medium and low in this case is
19 weighted essentially the same.

20 It's 0.14 and 0.11 and it says that you've
21 asked me to do some sort of high, medium, and low
22 ranking. I think I've done that but in fact, all I've
23 done is said something is high and everything else is
24 unimportant.

25 MR. COLES: Well, I actually set this up

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1 purposefully because this is what's a little bit
2 different from previous PIRTs and the ranking, we
3 weighted it towards the high end. So, there are some
4 --

5 CHAIR STETKAR: You did, and that's the
6 concern I have about overemphasizing the stuff that
7 eventually comes out deep, dark, blood red in your
8 tables, that it might have some inherent biases built
9 into it that you haven't necessarily tested very well,
10 such that the things that are judged to be important
11 are excessively important, just because of the way the
12 process does the math.

13 And I don't know that, I tried to play
14 around with it and that's why I am a bit concerned.

15 MR. COLES: I understand your comment.
16 The idea from the literature is that -- you see the
17 seven and nine and four -- is that in some cases, the
18 expert when he thought about the evaluation criteria,
19 he didn't really care about the meaning of low.

20 It was only when he reached the threshold
21 of high that he really cared. That's the underlying
22 thinking.

23 CHAIR STETKAR: Go on.

24 MR. COLES: So then you see in that bottom
25 table is where you bring the two weights together.

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1 Remember that the evaluation criteria have a weight
2 and then these ranking categories have a weight, and
3 this table just shows how those weights come together.

4 And then in the end, the result is that
5 the international company scored highest at 0.33,
6 followed by a domestic company at 0.32, and the
7 college and state university at 0.1, just a quick
8 example to give you a sense of how AHP works. And I
9 think that's all we're going to do with that.

10 In this slide, we, the facilitator,
11 initially proposed a set of evaluation criteria and an
12 AHP hierarchy based on critical safety functions and
13 sub-functions. We sent these to the experts before we
14 held our first solicitation and we went over them as
15 part of the Familiarization Meeting Number 4.

16 These criteria were then adjusted fairly
17 significantly by the Panel Members. They sent back
18 their thoughts to us and we adjusted these hierarchies
19 based on their comments.

20 So, hierarchies in general consist of a
21 top-level goal, a top-level evaluation criteria, and a
22 set of subcriteria for each top-level criteria. And
23 then we're going to use that criteria, remember, to
24 sort out the important differences between 20 plant-
25 operating states and 4 different outage types.

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1 So, we created eight hierarchies for each
2 of the eight goals; those goals are listed in that
3 bottom orange table. The goal that's shown in the
4 hierarchy is importance to low power shutdown and
5 core damage for internal events.

6 The Number 2, if you look in the box, is
7 importance to release a low-power shutdown and core
8 damage -- excuse me, yes -- for internal events. The
9 next one down is importance to core damage from
10 internal flooding.

11 Number 4, the goal is importance to
12 release from core damage due to internal flooding. So
13 you get the parallel construction.

14 We have core damage and release
15 considerations and we have the four hazards, internal
16 events, internal flooding, seismic --

17 CHAIR STETKAR: Garill, something that I
18 couldn't get my hands around is that the first three
19 of those top-level criteria are what I will call
20 functions, inventory control, heat removal, and RCS
21 integrity.

22 The last one is not a function, it's ways
23 that I can challenge those functions and it would seem
24 to me that would propagate up through my evaluations
25 in a particular plant operating state for internal

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1 events, fires, seismic, and so forth.

2 And because all of these weights and
3 everything are assigned at that top level, can you
4 explain to me why that internal event hazard is a top-
5 level criterion rather than something that propagates
6 up through the three functional top-level criteria?

7 And I know when you go to Level 2, you
8 have the containment integrity which is also a
9 functional criterion.

10 MR. COLES: That's right, I think you said
11 it exactly right that this particular category on the
12 right-hand side, the internal events hazards, on the
13 other hierarchies, it would be the fire events hazard
14 or the seismic events hazard.

15 But that represents the challenge to the
16 functions and I think the experts felt that
17 considering the impact of the challenge was an
18 important criteria because for a low-power shutdown,
19 there was some thinking for example that the
20 frequency, sometimes, of the event is higher than at
21 full power.

22 And also there's the concern that certain
23 plant operating states are more vulnerable than other
24 plant operating states because of a number of systems
25 being unavailable or taken out of service.

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1 So, they wanted to capture the challenge
2 part of the consideration. In some ways, in my mind
3 it's almost like the initiating consideration.

4 CHAIR STETKAR: But by doing that, if I
5 give that a weight of high and the other three mediums
6 and lows, suddenly those functions are not as
7 important as that initiating event if you will.

8 And in my mind anyway, what you're hearing
9 is my own thinking, the initiating event propagates up
10 through the other things that you're asking me to
11 evaluate, like the availability of systems in Plant
12 Operating State -- I'll pick a number -- 7.

13 And now I'm thinking about internal events
14 in Plant Operating State 7 as a challenge to functions
15 of inventory control, heat removal, and RCS integrity.

16 I don't get why it ought to be a separate and
17 distinct top-level criterion; that might numerically
18 mask the weights of the other functions.

19 Because you're asking me as an expert to
20 establish a normalized set of numerical weights among
21 those four, among those four.

22 MR. COLES: Right, I think that the
23 thinking is that these challenges, like I said,
24 they're more important at some POS than others.

25 CHAIR STETKAR: Sure, that's why I say

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1 when I think about internal initiating events in Plant
2 Operating State 7, as a challenge to inventory control
3 it might not be all that important.

4 But it's internal events through Plant
5 Operating State 7 to inventory control, and maybe
6 inventory control has a low weight in Plant Operating
7 State 7 anyway.

8 Then, I think of internal events through
9 Plant Operating State 7 to RCS integrity. I don't
10 think of it as a separate standalone top-level
11 criterion.

12 I think of it -- it's the same way as if
13 you were asking people to do a risk assessment,
14 structure the process as a risk assessment. And the
15 risk assessment looks at an initiating event through a
16 plant configuration to an outcome, and those outcomes
17 are typically organized by functions.

18 MR. KURITZKY: Garill, let me just speak
19 up for one second. So, I'm sympathetic to what you're
20 mentioning.

21 I love internal consistency and if I was
22 reviewing a report and there was a list of four
23 bulleted items, I saw three functions and internal
24 hazards, I would say, wait a minute, this doesn't
25 belong in this list. It's not consistent.

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1 But I think what Garill is getting at is
2 that, I don't know if this is a good analogy or not,
3 it's how important certain things are to the end
4 objective of what we're looking at.

5 And think of the cut set, how important a
6 different cut set is to the risk profile, and the cut
7 set has the initiating event frequency and it has the
8 failure of the mitigating functions or systems that
9 are needed there.

10 And so when you look at importance, you
11 can look at the importance of the different functions,
12 calculate the function's importance or something and
13 take a look at it.

14 But you can also look at for the
15 initiating event too, and so it might be that the
16 initiating event frequency is the real driver here,
17 not the ability of the various functions in the grand
18 scheme of things. So I just am wondering whether that
19 might be the idea that the experts are thinking.

20 CHAIR STETKAR: I don't know.

21 The thing that bothers me about it is that
22 you're asking the experts to say at that level how
23 important are fires, let's say, in Plant Operating
24 State 7, as compared to inventory control in Plant
25 Operating State 7.

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1 Because that's what you're asking them to
2 do and to me, I don't know how to do that. I don't
3 know how to compare fires in Plant Operating State 7,
4 weighting now 12479, compared to inventory control in
5 Plant Operating State 7, or if I'm now biased by the
6 way you've set up the process.

7 Mid-loop operation inventory control is
8 obviously very, very important and so fires can't be
9 very important. Whereas, they might if I organize the
10 thought process differently.

11 MR. COLES: I think that, in fairness, it
12 was difficult for them to weight -- that probably was
13 the hardest part of this process, weighting across the
14 top-level criteria.

15 CHAIR STETKAR: Well, maybe it wouldn't
16 have been as difficult if you didn't have that
17 initiating event box.

18 MR. COLES: Well, we did talk about this,
19 they did not want to remove it. They felt like it was
20 --

21 CHAIR STETKAR: They didn't?

22 MR. COLES: They did not.

23 MR. SHORT: It was added because of it.

24 MR. COLES: Because they thought it was a
25 discriminator that needed to be considered.

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1 CHAIR STETKAR: Okay, thank you.

2 MR. SHORT: Because we didn't have that
3 initiator. We had it just how you have it, we had
4 upper direction down at a lower level.

5 For example, we originally had human
6 failure events down to the lower level as a
7 subcriteria and they wanted that pulled out to the
8 top.

9 MR. COLES: Let's just go to the next
10 slide. I think we've probably talked about most of
11 the information on this slide.

12 This one is actually for importance to
13 release, and as you say, the top-level criteria that
14 gets added here is containment. Otherwise, it looks
15 like the previous slide.

16 And that's kind of true for the other
17 hierarchies then. They looked pretty similar, except
18 for if it's a fire hazard, then it's not internal
19 events we're thinking about, it's fire frequency and
20 volatility of fire.

21 So, we're only going to show you these two
22 hierarchies, but they look very similar.

23 The other thing I wanted to point out is
24 that for each top-level criteria, there was two
25 subcriteria.

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1 So, under inventory, RCS inventory
2 control, I don't know if you can read that, the
3 subcriteria are RCS water level and availability of
4 systems to make up inventory.

5 And under heat removal, we have a
6 subcriteria of heat load and availability of cooling
7 systems. And then in the actual instruction set that
8 we sent to the experts on how to fill out the
9 elicitation forms, we formulated the subcriteria's
10 questions to make them a little bit easier to apply.

11 And in the box, you see some of the
12 examples of how we formulated the subcriteria's
13 questions.

14 What is the heat load of the plant
15 operating state from power, decay, heat, and RCS
16 temperature, what is the vulnerability of the plant
17 operating state to maintaining RCS isolation, and
18 another example is what is the time required during
19 the POS to close containment versus time available?

20 So, they have to make sure that each
21 expert was thinking about the criteria in the same
22 way.

23 So, as I said, in preparation for
24 individual sessions, we performed this trial session,
25 not to be confused with the one that NRC did before we

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1 began our effort, with the participatory peer
2 reviewers.

3 We also, like I said, developed this
4 instruction manual and this facilitated checklist.
5 And then in the actual online sessions which took
6 about two hours, we started by explaining the intent
7 of each form and giving verbal instructions for
8 filling out the form.

9 We provided warnings about the potential
10 for certain kinds of motivational cognitive bias and
11 pitfalls in logic that we saw.

12 For example, you can kind of be internally
13 consistent if you say A is greater than B and B is
14 greater than C, then C can't be greater than A. That
15 was a pitfall that we pointed out to them.

16 We asked the expert to provide specific
17 examples while they were with us on the phone and
18 online of how they would fill out the form. And then
19 we asked the facilitators, we probed to establish that
20 we thought the expert understood how he was supposed
21 to fill the form out.

22 And then one thing we learned in the trial
23 session with the participatory peer reviewers is that
24 there was no way the experts were going to be
25 available to fill out the form in real time.

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1 So, for the two hours, we just established
2 that we thought they understood the form, and then we
3 gave them a week to actually fill it out. And we were
4 asking, if you recall, for comments, too, to support
5 some of their assignment selections.

6 And the next slide, in this slide we show
7 two examples or two example tables of the top-level
8 evaluation criteria for the two top-level goals. Of
9 course, there's eight goals so there's eight of their
10 tables.

11 And the way it works is if you look at one
12 of the forms, say the form on the left, you see a
13 block of questions there.

14 And the construction of this block of
15 questions is similar for each block, and the questions
16 go, for example, is RCS inventory more important than
17 heat removal? Or is heat removal more important than
18 RCS inventory?

19 So, you pick the cell to place your answer
20 and the way the spreadsheet works, the other question
21 automatically hashes out and gets removed.

22 And then you choose how much more
23 important one criteria is over the other by going to
24 the yellow table, that's the lower right, and picking
25 a comparison category from the table, either A, B, C,

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1 D or E.

2 And you'll recall that those correspond to
3 equal to, slightly more, moderately more, strongly
4 more, or exceptionally more --

5 CHAIR STETKAR: Numerically, one, two,
6 four, seven, and nine. Right?

7 MR. COLES: I don't know, yes.

8 CHAIR STETKAR: One, two, four, seven, and
9 nine, is that correct? That's the way it was
10 implemented when you finally pushed --

11 MR. SHORT: I think that's right.

12 MR. COLES: They didn't see that part.

13 CHAIR STETKAR: They didn't but I can
14 confirm by reproducing spreadsheets that they're one,
15 two, four, seven, and nine.

16 MR. COLES: You're right, that's correct.

17 MR. SHORT: And I need to correct Garill a
18 little bit there, we did introduce those numbers in
19 the group elicitation session. Just your comment,
20 they had similar concerns like you as to how their
21 results were being compiled.

22 So, at the end of that session, we did lay
23 out, we did tell them what the numerical assignments
24 were for those values.

25 CHAIR STETKAR: I'll let you go on because

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1 of the time. We're going to finish this by about noon
2 or so, so that's what I'm working for. We'll play
3 catch-up this afternoon or not. So, you've got about
4 40 minutes.

5 MR. COLES: Okay, and the next slide,
6 Alan, this is similar to the previous form. This was
7 the one that was used to perform the comparalyzed
8 comparisons for the subcriteria.

9 You'll recall that there are two
10 subcriteria for each top-level criteria so that's why
11 there are only eight blocks of questions here.

12 And ultimately, the weight of the
13 subcriteria is going to be a function of the weight of
14 the associated top-level criteria, combined with the
15 weight of that subcriteria against the top-level
16 criteria.

17 And then I didn't point this out on the
18 other form but you'll notice on the right-hand side,
19 again, we asked the expert to provide a brief
20 explanation or basis for the comparison categories
21 that they assigned.

22 And for these tables, those are pretty
23 filled in. For this table and the ones on the
24 previous page, those were almost entirely --

25 CHAIR STETKAR: Garill, I should have

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1 asked you this and I didn't exercise my spreadsheets
2 enough. I ran out of time.

3 If I'm one of the experts and I assign
4 high to all four of the top-level criteria, HHHH
5 across the board, and Matt's another expert and he
6 assigns medium to all four top-level criteria, medium,
7 medium, medium, medium, what each of us are saying is
8 that we can't distinguish relative importance among
9 those four. We would assign equal relative importance
10 to each one of them.

11 When the final results are presented,
12 developed, am I given more weight simply because I put
13 an H in each of those boxes and he put an M?

14 MR. SHORT: No, not the way we did the
15 evaluations. So, he'll get to that in just a little
16 bit.

17 CHAIR STETKAR: I hope you do.

18 MR. SHORT: I don't know if there's a
19 specific slide on it but remember that with the
20 weighting, you're just comparing the criteria to each
21 other.

22 So, if they're all high, they're all going
23 to get -- are you talking about comparisons across --

24 CHAIR STETKAR: That's intra-evaluator.
25 I'm talking about inter, between experts, when you

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1 finally aggregate the results, am I somehow given a
2 higher weight simply because I put Hs in all four
3 boxes compared to Matt who put Ms in all four boxes.

4 MR. SHORT: I think our later discussion
5 will show how that's done.

6 CHAIR STETKAR: I couldn't figure that
7 out.

8 MR. COLES: And the next slide, this table
9 is what we call the subcriteria ranking form and it
10 does a couple things for each of the 16 subcriteria.
11 The first thing it does is it does a comparalyzed
12 comparison across the ranking categories.

13 These generically are the high, moderate,
14 and low to establish the relative weights, like we
15 were talking about a little bit earlier.

16 That's done on the top part of that form,
17 and then the bottom part of that form, we record the
18 definitions of the ranking categories used by the
19 experts, which by the way, were different across the
20 experts.

21 So, in this particular form, this is the
22 form for availability of cooling systems and the
23 ranking categories are not very available, available,
24 very available, representing a range from high
25 availability to low availability.

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1 And so then down in that lower left-hand
2 corner of that orange box, we provide there what these
3 categories meant to one of the experts as an example.

4 So, for this expert, not very available
5 meant a single train of RHR with support. Available
6 meant both trains of RHR are available, and very
7 available meant RCS intact and at least two SGs or
8 steam generators available.

9 Other experts' definitions were different.
10 I can tell you that some were much more complex than
11 others but that's just an example. We asked the
12 experts to stay internally consistent to define for
13 themselves what the ranking categories meant.

14 MEMBER BLEY: What's the thought process
15 behind having them evaluate these and then tell you
16 what their criteria are, rather than agreeing on the
17 criteria so that they're all using the same basis as
18 they evaluate?

19 MR. COLES: I think there was enough
20 differences in people's mental models and the way they
21 wanted to think about importance that we decided it's
22 a little more work to do it this way.

23 But we wanted them to be internally
24 consistent with whatever their mental model is because
25 when we show you the next slide, there's a lot of

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1 entries and we wanted them to kind of stay consistent
2 with how they were thinking about these rankings.

3 So, we'll just do that, let's go to the
4 next slide. This is sort of the final form that they
5 fill out which we call the Plant Operating State
6 Importance Ranking Elicitation Form, or just a portion
7 of it.

8 You see the plant operating states there
9 on the Y axis and the evaluation criteria on the X
10 axis. But remember, in the actual form there were 20
11 plant operating states and there were 16 subcriteria.

12 So, this is a big table. So, there was a
13 lot of entries they were making.

14 And then there's kind of a space where we
15 allowed the experts to provide comments or bases for
16 those elicitations if they choose. And this is the
17 table that was normally not completely filled out but
18 to the extent that they felt they needed to fill it
19 out.

20 MR. SHORT: Some experts put notes down at
21 the very bottom of the table as a general rule about
22 how they did this, rather than in each individual
23 cell.

24 MR. COLES: So then using these ranking
25 categories which have a weight and then using the

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1 weights that was determined using comparalyzed
2 comparison for the evaluation criteria, then we're
3 able to develop a priority for each plant operating
4 state.

5 We're going to show you the results a
6 little bit.

7 Before we do that, on the next slide I
8 want to talk a little bit about out face-to-face
9 meeting.

10 It's a three-day meeting in Washington
11 D.C. we started the meeting by providing to the
12 experts both the aggregate and the individual but de-
13 identified results and we also highlighted some of the
14 differences we saw between the ways they filled out
15 the forms.

16 And also at the beginning of the meeting,
17 based on their experience of filling out the
18 individual elicitation forms, they had some
19 suggestions, some refinements they wanted to make on
20 the group elicitation form.

21 I think the main comment is they wanted to
22 differentiate -- for the most part, we assume that the
23 plant operating states that comprise an outage type
24 can be defined in the same way.

25 But in a handful of cases, they want to

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1 define a specific, a particular plant operating state
2 a little bit differently for one outage type and
3 another outage type.

4 And as I recall, that was kind of the main
5 adjustments we made to the table in the front end of
6 that group meeting.

7 And then the main part of the meeting
8 consisted of an expert for each form. We allowed the
9 expert to described the basis for why they filled out
10 each entry the way they filled it out.

11 And then they received, we allowed,
12 feedback from the other experts. We allowed a set
13 amount of time for that activity. So since we're
14 going to go over a lot of entries, we set a time limit
15 for the expert to explain it and get the feedback.

16 And then during that process, each expert
17 recorded on their forms or their notes changes that
18 they potentially intended to make based on the
19 interaction and the discussions with the other
20 experts.

21 And then the experts are given a week I
22 think to finish and send us back what we'll call the
23 group elicitation results, their final results.

24 As part of the group meeting, we also held
25 a brainstorming session on low-power shutdown PRA

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1 modeling uncertainties for issues like we brought up
2 earlier not explicitly addressing the PIRT.

3 Primarily, these have to do with the
4 assumptions, state-of-art PRA practice for low-power
5 shutdown and a lack of information to inform certain
6 parts of the low-power shutdown PRA.

7 We can skip this slide I think, this just
8 tells you the kind of results -- well, we're going to
9 look at the results anyway so let's just go to the
10 next slide.

11 So, the plot here on the left, the top
12 part of the slide, shows the aggregate results
13 graphically displayed. So this is the primary result
14 but this is the aggregate.

15 We could have shown you all the individual
16 graphs but we didn't, we're just showing you the
17 aggregate.

18 If you look there to the right-hand side
19 of that graph, we call it a heat chart, you see a
20 little legend and that indicates or kind of shows you
21 the relationship between the colors and the numerical
22 priority or importance values.

23 So you can see that red is high importance
24 and pale yellow is low importance, yes.

25 MEMBER CORRADINI: You're going to get to

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1 26? So I'm as interested in 26 as in 21, which is
2 when they disagree, where they disagree, and the
3 degree of disagreement.

4 MR. COLES: Yes, we are going to
5 explicitly get to some slides that show that.

6 MR. SHORT: That's why he was talking
7 about Slide 26.

8 MEMBER CORRADINI: Yes, Slide 26 is where
9 you show particularly on core damage and on release,
10 but I'll wait.

11 My only thought is this -- my first
12 reaction, since I'm not an expert in any of this, I
13 participated in PIRTs long ago and they were painful.
14 That can go on the record.

15 And my only observation of all this is I'm
16 not surprised by the results. So, is this biased or
17 did everybody just come from the same school of
18 thought?

19 Before I would have started this, I would
20 have figured five and six were important and coming
21 into and out of the event is where I'd worry about it
22 because I've started manipulating water inventory and
23 something's going to go wrong and God help us.

24 So, is it just because I don't understand
25 enough about how things operate in low power and

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1 shutdown that I was pleased or not surprised?

2 This is my immediate reaction looking at
3 this, is I thought, oh, okay, so this is a surprise
4 because I would have thought that going in.

5 CHAIR STETKAR: Is it because the only
6 low-power and shutdown studies you've ever seen had
7 only looked at mid-loop operation and therefore, you
8 are biased in your understanding of low-power and
9 shutdown risks because of it?

10 MEMBER CORRADINI: I will admittedly say
11 this is an area of experience that I have almost
12 nothing. So, this didn't surprise me but maybe that's
13 good, I don't know. This is my reaction when I look
14 at --

15 MR. COLES: It confirms what you
16 intuitively thought about the importance of these.

17 MEMBER CORRADINI: Yes, but I'm of low
18 knowledge base so that could mean nothing.

19 CHAIR STETKAR: Let me ask you a couple of
20 things on this.

21 What I've been trying to get at is does
22 the process, the numerical process, and the lack of
23 expert understanding of how all of those numbers are
24 put together in the spreadsheets excessively
25 accentuate what I'll call a knife edge of importance?

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1 In other words, things that fall away very
2 quickly from those deep, dark red lines on 5B and 6,
3 and to a lesser extent, 10, let's say.

4 In other words, if the numbers were
5 different, would it be more of a blurred -- the second
6 part of this is when you did the aggregation, it's my
7 understanding that if there were -- I've forgotten how
8 many experts you had.

9 MR. COLES: Seven.

10 CHAIR STETKAR: Okay, seven experts, each
11 expert had a number associated with each box on this
12 plot, right? There was a number, 0.244762.

13 MR. COLES: Mm-hmm, the final priority.

14 CHAIR STETKAR: Final priority. And you
15 took the geometric average of those to determine what
16 the final number was in the box, just a geometric
17 average. Is that correct?

18 MR. COLES: Mm-hmm.

19 CHAIR STETKAR: How does this process --
20 as I said, I've fiddled around with similar-type
21 things a long time ago and to me, there's two sources
22 of uncertainty.

23 There's uncertainty within an expert, so I
24 don't quite know whether, if I was given the numbers,
25 I ought to assign a seven or a nine. And I'll say

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1 it's seven for now but it might be a nine. And
2 then there's inter-expert uncertainty which typically
3 is a lot larger because of all of the things you
4 mentioned earlier, that my personal definition of very
5 available might be much different than your personal
6 definition of very available, even though each of us
7 individually does our evaluations consistently.

8 Accounting for that inter, between expert,
9 variability, if you want to call it that, to smear the
10 colors in this, in my experience has been very
11 important. It's what Mike was eventually getting to
12 when we get to Slide Number 26.

13 You do see substantial differences between
14 experts in terms of very, very deep dark red versus
15 kind of yellowish-stuff. Your use of the geometric
16 value doesn't account for that uncertainty.

17 So, if I weight each of my experts
18 equally, I'll get a different-colored picture.

19 MR. COLES: We actually were kind of
20 interested in that question too, and I know I'm not
21 the statistician of the team, but Amanda White did --
22 because we were interested in how you aggregate so we
23 actually did a number of different aggregations.

24 For example, we did an aggregation where
25 we aggregated the inputs, right? So, we went back to

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1 the comparison and we aggregated at that level and
2 then we used the arithmetic mean and geometric mean.

3 And I don't want to be glib about it, but
4 we didn't see a lot of difference. We kind of kept
5 coming back to a heat plot that looked much like that.
6 That's a data-point.

7 We did think about it. We used the
8 author's, Saaty's, recommendations for how to do
9 aggregation.

10 CHAIR STETKAR: Yes, I read the paper and
11 there's a single sentence in there that says you will
12 use the geometric value.

13 There's no basis, at least in the paper,
14 of why that -- now, I didn't go back and look at --
15 Dennis might have -- more of the research to justify
16 that. It's just a single sentence that said usage and
17 metric.

18 MR. SHORT: Well, I think the purpose of
19 the geometric mean is to not over-bias high rankings
20 versus low rankings because if you're giving something
21 a nine versus a one, an arithmetic average would bias
22 towards the nine.

23 So you use a geometric average --

24 MEMBER BLEY: There's two sides to that.
25 An arithmetic average will give over-credit I'll say

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1 to a high outlier.

2 On the other hand, the geometric average
3 will bias to the low one. If you get a low outlier,
4 it all moves down there. So, you pay a penalty either
5 way.

6 MEMBER KIRCHNER: Can I ask kind of a
7 different question? Did you with all this information
8 see any biases come in? I'm going back to your
9 experts, five PRA experts.

10 They probably looked at the world through
11 a different set of glasses than the operations people.

12 I think if I'm the operator of my own plant, I'm
13 probably feeling less vulnerable when I'm in a drained
14 configuration or a mid-loop, or whatever, than when
15 the PRA probably are assessing it.

16 So did you see anything come out where the
17 PRA folks put the emphasis here, the operations people
18 put it there, and can you try and reconcile that in
19 any way? Or maybe it didn't show it, maybe everyone
20 was in agreement?

21 MR. COLES: We did notice there was a
22 difference between the PRA results and the other two
23 experts.

24 MEMBER KIRCHNER: I guess what might have
25 been interesting is to present the results with just

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1 the PRA guys versus the non-PRA, right? Because they
2 do think about things differently.

3 We talked about that a lot during the
4 group elicitation session where the outage guys
5 definitely had their opinions about what were the most
6 risky configurations of the plant and why those were,
7 okay.

8 Did we specifically do an analysis that
9 stripped them out and see how that might have been
10 different? We didn't really.

11 MEMBER BALLINGER: Did you observe in the
12 final results, did you observe any changes of people's
13 opinions related to who they were and who they
14 influenced?

15 For example, the PRA people talking with
16 the plant people, did that result in changes of the
17 PRA people's answers or the plant people's answers?

18 MR. SHORT: So, I believe the answer to
19 that is yes. I do believe that certain experts were
20 swayed by the judgments of another person, of another
21 expert.

22 What we don't see is, and the only way to
23 determine that maybe is by going back and comparing
24 the results of the individual worksheets from the
25 aggregate from their final worksheets.

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1 We didn't actually do much of an analysis
2 to see how much, how impactful that was.

3 But there was clearly in the group
4 elicitation session experts who said, oh, I didn't
5 think about that, and so the presumption was that they
6 went back and changed their assessment.

7 We have all those results, we just didn't
8 do that.

9 MEMBER BALLINGER: It would seem that
10 would be a valuable endeavor.

11 MR. SHORT: And insight.

12 MR. COLES: So, just to finish out this
13 slide, I'll just repeat what Michael already observed,
14 that the heat plot shows that the red or the orange
15 colors indicate that the plant operating states during
16 or coming into or out of mid-loop, early mid-loop, and
17 the mid-loop are the more important to risk of core
18 damage or release.

19 Mid-loop is Number 6 so Plant Operating
20 State 6, or early mid-loop is, and then mid-loop at
21 10, Number 10.

22 And there is where the water in the
23 reactor vessels drain down to below the inlet flange
24 to the main piping steam generators so that the steam
25 generator can be opened up for maintenance.

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1 But then once the nozzle dams are in, so
2 that's that barrier they put in the steam generator.
3 Once those are installed, then the reactor vessel is
4 flooded back up, at least for refueling, so that they
5 can unload and load fuel.

6 So that's why in 8E and 8L, I guess that's
7 probably the easiest explanation for why that's sort
8 of a paler orange is because there is where the
9 reactor flooded back up.

10 Then the reactor levels lowered again to
11 down below the inlet flange so they can take those
12 nozzle dams and those isolation barriers out of the
13 steam generator.

14 And then we provide a key over on the
15 right-hand side for what the plant operating states
16 are. I didn't plan to go over them unless someone has
17 some specific questions.

18 MEMBER KIRCHNER: You weren't surprised by
19 these results?

20 MR. COLES: These aren't surprising
21 results, no.

22 MEMBER KIRCHNER: No, not at all.

23 MR. SHORT: They are kind of consistent
24 with some of the results that were presented in the
25 1993 NUREG report with a couple of exceptions which we

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1 couldn't quite understand.

2 MEMBER KIRCHNER: So, Alan, going back to
3 what you said, before you had PIRT you just guessed
4 this and put your emphasis there?

5 MR. KURITZKY: Yes, before we had the
6 PIRT, right.

7 MEMBER KIRCHNER: You put your heads
8 together and did a mini PIRT and had the same --

9 MR. KURITZKY: Right, so we had several of
10 the same TAGs, augmented the TAG with a couple of
11 additional experts in shutdown PRA, which ended up
12 being on the actual PIRT.

13 And so we came up the general set of the
14 same expectations and so that just confirmed what we
15 had thought.

16 And again, as you've heard Chairman
17 Stetkar mention, there's reason, there's potential for
18 a lot of bias because previous studies have focused on
19 these areas, and that may be because they are in fact
20 the most important things, or it could be that we
21 haven't recognized them and thought there were other
22 things.

23 MEMBER KIRCHNER: The plants will tell you
24 this is when they're most vulnerable.

25 MR. KURITZKY: Right, or there could be

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1 different --

2 MEMBER KIRCHNER: Or most prone to human
3 error. When everything's buttoned up, you're in
4 pretty good shape here.

5 MR. KURITZKY: But obviously, again,
6 Chairman Stetkar is familiar with other studies
7 probably overseas where he has experience that shows
8 other things might be important, depending on the
9 nature of the plant and how they operate and what
10 equipment they take out.

11 So, we're not privy to that information so
12 I don't know. But, again, the potential for bias
13 because the experts were familiar with the study so
14 you just kind of reinforce that same bias, that's
15 obviously a concern.

16 But this is not unexpected to see these
17 results. Intuition tells you, your engineering
18 judgment tells you, these are likely to be the most
19 important.

20 MR. WOOD: I just wanted to add that our
21 interactions with the TAG were more focused on helping
22 us with our PRA modeling and what analyses we needed.

23 And it was a different type of input then,
24 this PIRT process, so there was not a lot of emphasis
25 on let's really figure out what's most important.

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1 The tag's input was more focused on don't
2 just focus on the one thing that's more important.
3 You need to be a little more comprehensive.

4 MR. COLES: So maybe we'll --

5 MEMBER BLEY: Just an aside, back to I
6 guess Steve's comment, you don't know what changed
7 since 30 years ago. Several things changed, there are
8 now procedures for when you're in this situation.

9 Most people remove the fuel from the
10 reactor which they didn't do before and there's
11 improved instrumentation that wasn't around back then.
12 So, all those things certainly did change.

13 MR. SHORT: Yes, one of the reasons for
14 the comment, my comment on that, was the basis for
15 those results were in some letter report that wasn't
16 documented in that NUREG report. And we didn't have
17 access to that letter report from 1992 or 1991.

18 MEMBER BLEY: I'd go a little further to
19 say expert judgment before those early PRAs on
20 shutdown, expert judgment was there is no risk when
21 you're shut down.

22 MR. SHORT: Well, yes, but I guess the
23 point was that one of these non-mid-loop-related
24 pauses in that report was the most important POS.

25 We could not figure that out, okay,

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1 because supposedly, the reasoning was in a documented
2 letter that of course is long gone so I don't know
3 what the basis for it was.

4 But we are trying to figure out why that
5 one POS in their report was so much higher than one
6 that showed up as kind of not important in ours.

7 MR. COLES: This slide shows the most
8 important contributors to the plot's priority in terms
9 of the subcriteria that contributed to the final
10 priority.

11 There is for internal events but the
12 graphs for internal flooding, they look pretty similar
13 to this. So, again, along the X axis are the column
14 headers for the subcriteria, and then the Y axis are
15 the plant operating states.

16 The top graph is for importance to low-
17 power shutdown core damage and the bottom graph is
18 importance to release the low-power shutdown damage
19 for internal events.

20 And the top graph, you can see the darker
21 colors there on the right and in certain column
22 headers. Those darker colors, those rows are RCS
23 water level, RCS isolation, and human-initiated
24 errors. And so those are kind of the dominant
25 contributors to whatever the priority is.

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1 And it's a very similar case in the bottom
2 graph, except for containment isolation capability
3 which also had some darker colors. So, this was just
4 a way of trying to use the results to understand what
5 the important contributors were.

6 In the next slide, we showed the
7 importance of plant outage types. As I mentioned
8 earlier, the importance of the plant outage types of
9 were determined by looking at the plant operating
10 states that comprise them.

11 And I think we also mentioned earlier that
12 the plant operating states were considered
13 sufficiently similar across outage types of. In most
14 cases, I think it would be defined in the same way;
15 there were some exceptions to that.

16 So Plant Outage Type 1 is a non-drained
17 maintenance outage without RHR, that's the upper left.
18 The upper right, Outage Type 2, is non-drained
19 maintenance with RHR.

20 Plant Outage Type 3, that's the lower
21 left, that's the drained outage with RHR. And then
22 the lower right is the refueling outage.

23 So, you can see in the two drained
24 outages, the two bottom graphs, that it was kind of
25 the same plant operating states that were important.

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1 CHAIR STETKAR: Garill?

2 Suppose we were doing this back in the
3 early 1980s when I refueled my plant once a year and I
4 went into a Type 1 outage about eight times a year,
5 and I went into a Type 2 outage about three times a
6 year.

7 How would that affect my different colors?

8 Because all you did is look at relative
9 from fractions of time in each outage without regard -
10 - there's statements in your report saying, well, gee,
11 because we go into refueling much more often than
12 these other types of outages, therefore, refueling is
13 more important.

14 That might be true today and I'm not
15 arguing that it is, but without considering my
16 exposure frequency for the other types of outages in
17 addition to the fact that I might be operating on RHR
18 with fuel in the reactor in the Type 2 outage for, I
19 don't know, a week and a half, if I have to operate a
20 week and a half six times a year, I might give a lot
21 higher weight to plant outage type too, for example.

22 MR. COLES: Yes, I think that's a good
23 comment and I think --

24 CHAIR STETKAR: And perhaps given today's
25 snapshot of the average industry experience, this

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1 might be okay but I didn't see anywhere that you told
2 people to kind of think about the frequency of
3 entering each of these outage types.

4 MR. COLES: We didn't write it down.

5 MR. SHORT: But the number of times we
6 were in --

7 (Simultaneous Speaking.)

8 CHAIR STETKAR: It's basically what is my
9 total exposure periods over the course of a year for
10 being in each of these configurations?

11 MR. SHORT: We did have outage reports for
12 the plant for the last several years and we've based
13 it on that. But you're right, we did not specifically
14 say how this might change if you had several --

15 CHAIR STETKAR: I was shift supervisor at
16 Zion and we were lucky if we could operate a unit a
17 month without it tripping and having to be shut down
18 for some period of time in Plant Outage Type 1.

19 So our exposure to those conditions was a
20 heck of a lot different than what plants face today
21 and perhaps what the experts were thinking about when
22 they did this kind of balance.

I'm not necessarily arguing it, just given today's snapshot for an average plant --

25 MR. SHORT: I think this is a good point

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1 for us to make in our report.

2 MEMBER SUNSERI: Just to add to John's
3 comment, I think you would be entering a Plant Outage
4 Number 1 probably for some forced reason. Some
5 important equipment might not be available which would
6 also increase the risk of that plant outage time too.

7 MR. COLES: I think those are good
8 comments. In the interest of time, let's go to the
9 next slide. In fact, let's not do that, let's go to
10 the next one because they're really similar.

11 So, on this slide, I wanted to show where
12 we de-aggregated the individual results. This slide
13 shows the individual importance weights for the
14 subcriteria for each top-level criteria across the
15 experts.

16 So each dot, each colored dot, is a
17 different expert and the reason I show this is to show
18 you that we have good examples of both tight groupings
19 and examples of spread-out opinions, right? So, on
20 that upper left-hand graph, you probably can't read
21 that but it's RCS inventory control.

22 And you can see a pretty tight grouping of
23 weighting values of the two subcriteria, which are
24 availability assistance to make up inventory and RCS
25 water level, which you can see the experts considered

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1 the water level being significantly more important
2 than the makeup.

3 And the tight groupings, you can see other
4 tight groupings if you just kind of scan through the
5 graphs. Down in the lower right-hand graph on the
6 seismic hazard, you can see a pretty spread-out
7 grouping of weighting values for the two subcriterias.

8 Especially for the one there on the right
9 in that lower right-hand graph, that's the
10 vulnerability to seismic damage at the plant operating
11 state. I suspect that this kind of means we just have
12 a lack of understanding, information, data. So, we
13 got a lot of different opinions in that.

14 We showed the experts this information
15 during the group meeting. We didn't ask them to draw
16 conclusions; they did respond to some of the things
17 they saw.

18 The next chart --

19 MEMBER CORRADINI: So, this one, can you
20 lead us to -- I'm trying to understand if I'm more
21 worried about red, dark red, or white.

22 MR. COLES: So, you're more worried about
23 red and brown, the really dark red and red because
24 this indicates level of disagreement.

25 MEMBER CORRADINI: Okay, so what struck me

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1 was they aren't where my -- let me take that back.
2 Except for SCR8, which I can't remember what it is,
3 they're not in the areas where the PERT says we ought
4 to worry about it.

5 It's in areas where I'm not worried about
6 it, which is in 8E and 8L before 5 and after 10.

7 MR. COLES: Yes, I think it's true that
8 some of the --

9 MEMBER CORRADINI: That's a quick color
10 interpretation but I'm trying to struggle -- and they
11 map pretty much between core damage and internal event
12 release although you add 9 and 10, SCR9 and 10, for
13 release.

14 So does this worry you? I'm trying to
15 understand.

16 MR. COLES: About what the message is?

17 MEMBER CORRADINI: Yes.

18 MR. COLES: What determined overall,
19 here's a couple things we can see.

20 Overall, 85 percent of the time, a
21 majority of the experts agreed on the ranking category
22 assignments to the POS so that majority means 4 or
23 more experts out of 7.

24 85 percent agree on the ranking category.

25 65 percent of the time, there was a high-level of

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1 agreement in the ranking categories and we defined
2 high-level as meaning 5 or more experts out of 7
3 agreed on the ranking category.

4 I think you do a lot of assessment of
5 these graphs, but we found that in areas of agreement,
6 so that's the white and the yellow and orange to some
7 extent, sometimes that correlated with important
8 contributors like RCS isolation, which everybody
9 agrees is kind of an important contributor on the
10 previous graphs.

11 And sometimes, there is a disagreement of
12 the brown or red that are correlated with areas of
13 acknowledged uncertainties. And this is certainly
14 true for internal and external event frequency, the
15 vulnerability of low-power shutdowns, configurations
16 to fire, internal flooding, and seismic events.

17 And it was also true for containment
18 isolation capability. But I think the bigger message
19 is mostly there was agreement.

20 I think if we could do this chart over, we
21 might flip the colors something and make it more
22 intuitive but --

23 MEMBER REMPE: So when I was looking at
24 this, I go back to that earlier slide on 21 and kind
25 of look at both of those together.

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1 So I wouldn't change your geo-graph but to
2 me, it seems like it's great that you have white
3 things in an area that's not important on Slide 21
4 when you only have three experts say that Plant State
5 or 6, they agree that's in that area.

6 To me, I'd be more concerned. Maybe I'm
7 not understanding some of your results, but it seems
8 like then Slide 21 should have a lot more uncertainty
9 than it does. Am I misunderstanding some of your
10 results?

11 MR. COLES: Yes, Slide 21 is aggregated
12 results.

13 MEMBER REMPE: But it hides some of the
14 uncertainty conveyed by 26.

15 MR. COLES: Yes, no question about that.

16 MEMBER REMPE: And maybe that's John
17 geometric mean stuff.

18 (Laughter.)

19 CHAIR STETKAR: It's this little picture
20 that I keep drawing for myself.

21 MEMBER REMPE: It seems like there ought
22 to be a lot more fuzzy colors in Slide 21 to convey
23 that -- it's great the experts agree that something
24 unimportant is not important but when you get to the
25 important ones is where I'm concerned.

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1 MEMBER BALLINGER: But I guess I would
2 have also thought that there would be a little more
3 white in 5 and 6. To me, I'm just looking at this --

4 MEMBER SUNSERI: Maybe I'm interpreting
5 the chart wrong but to me, this illustrates the
6 diversity of thought of bringing a group of people
7 together.

8 If it were all white, you might as well
9 just have one expert do it instead of a group. So, at
10 least this chart, I'm kind of happy to see there's
11 some variety in there because it factors in the
12 diversity of thought.

13 It seems to be I'm going to say fairly
14 randomly distributed throughout the chart, so that
15 means they didn't always agree on everything at once
16 and they didn't always disagree on everything at once.

17 Some of them got the diversity you're
18 looking for by bringing everything together, that's
19 what this tells me.

20 MR. SHORT: Yes, well, I think the other
21 thing is that the experts readily admitted that
22 qualitatively doing the ranking of those top criteria
23 was really hard to do and so that might be reflected a
24 little bit in some of the diversity in here too.

25 CHAIR STETKAR: You're always going to get

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1 -- as I said, you're going to have intra, within
2 expert, sources of uncertainty, should I say this is a
3 seven or a nine or whatever words you use.

4 More importantly, accounting for in your
5 overall results, carefully accounting for the
6 variability among experts is important.

7 You might draw the same conclusion that
8 Plant Operating State 6, let's say, is at the top of
9 the heap.

10 On the other hand, the heap might not have
11 a sharp point, it might just be a mound, which is
12 what Joy is getting at, that indeed, drawing a
13 conclusion that 6 and 5B and 10 are the only things
14 that we ought to look at because clearly the experts
15 know that those are the most important.

16 A more careful accounting for this
17 variability that characterizes uncertainty might say,
18 well, yes, we certainly need to look at those but the
19 experts are telling us that there are only a few,
20 maybe only a few, that we really can get away with
21 doing some sort of simplified analysis.

22 MEMBER CORRADINI: I'm going to apologize,
23 we have two new meetings but the one that took me is
24 8E and L, only three experts agreed and those were
25 your low- probability ones after the dams are removed,

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1 you filled the water, you're refueling, life is good.

2 And that just struck me as interesting.

3 MR. COLES: Yes, I know that maybe it
4 would have been interesting to see the PRA.

5 MEMBER CORRADINI: I use the word
6 interesting because I then ask myself what were they
7 thinking that they were concerned about or not
8 concerned about. That's where I'm coming from.

9 MR. COLES: I wish it would have showed it
10 but we didn't want to single out individual profiles
11 but there were differences. Some people's mental
12 models of risk were just different than others, that's
13 for sure.

14 MR. SHORT: We can certainly go back and
15 look at 8E and 8L and do a little bit more assessment
16 on that.

17 CHAIR STETKAR: I think we're trying to
18 approach this, though, not particularly from a
19 specific plant operating state.

20 I'm trying to approach it for is there
21 something inherent in the way that the methodology was
22 applied that excessively reinforces particular
23 conclusions at the expense of others.

24 Because people, especially if this report
25 becomes more genericized, people will use this to

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1 govern future decisions about things that I can't
2 ignore.

3 And can't ignore to a lot of people means
4 there's precisely no risk because I don't do anything
5 with them.

6 MR. COLES: I understand.

7 CHAIR STETKAR: And that's the danger so
8 perhaps just a better acknowledgment of the
9 uncertainty and how it might be addressed even though
10 you maybe didn't address it.

11 MR. COLES: Okay, we have a few slides on
12 that, speaking of uncertainty.

13 CHAIR STETKAR: Okay, go on. I'm going to
14 let you finish let's see if we can get done pretty
15 quickly here because this afternoon we have to pick up
16 other things.

17 MR. COLES: In this slide, we identify two
18 important sources of PIRT process uncertainty, so how
19 we perform the process, that were identified by the
20 experts and I just want to share those.

21 One source of uncertainty was related to
22 the fact that the PIRT parameters are assumed to be
23 static-fixed when, in fact, they're not.

24 In reality, they vary from the beginning
25 of the plant operating state to the end because you

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1 arrived at the next state by the end of the state.

2 And also, they vary for certain situations
3 and a good example of that that one of our experts
4 worried about a little bit is that for Plant Operating
5 State 5B, this is about the hatch, I can share that,
6 right?

7 So, usually, typically in this state, the
8 hatch is assumed to be closed.

9 CHAIR STETKAR: Let's talk about that this
10 afternoon if you will, because we're going to talk
11 more about that this afternoon.

12 MR. COLES: Yes, understood. Well, then
13 we can talk about maybe the next source of uncertainty
14 and that was the point that we mixed together low-
15 power and shutdown plant operating states, we mixed
16 them together.

17 MEMBER KIRCHNER: Buttoned-up versus
18 opened-up is the essential difference?

19 MR. SHORT: Yes, exactly right. They're
20 fundamentally different operating regimes and one of
21 the subcriteria that kind of illustrates how that is
22 kind of an issue was the subcriteria we titled RCS
23 Water Level.

24 So, that makes a lot of sense when we're
25 thinking about shutdown but it makes less sense when

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1 you're talking about low power.

2 I think in practice, what happened is that
3 the experts primarily assigned a low-ranking category
4 for those plant operating states that were associated
5 with low power, and that's how they dealt with it.
6 But it may have been more appropriate to do something
7 more nuanced or do low power different.

8 But we actually brought it up with the
9 experts and we decided as a team to stay with the
10 definitions we have where they thought they could deal
11 with those definitions internally in their mental
12 model of how they picked the comparison categories.

13 The next slide is a slide on the
14 brainstorming session. I think we spent a half a day
15 or a little more on it.

16 The brainstorming session was about
17 identifying low-power shutdown modeling uncertainty
18 issues, primarily having to do with assumptions you
19 make in the PRA, the state-of-art performing PRA for
20 low-power shutdown and the lack of information they
21 wished they had.

22 The team identified 19 issues and also
23 along with this issue, they identified some
24 suggestions about maybe what could be done to go
25 towards addressing the issue. I just listed a really

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1 small sample there.

2 One of the issues has to do with
3 initiating event frequency. A number of the experts,
4 I think most of the experts, kind of believe that the
5 frequency of internal events is higher at low-power
6 shutdown than at full power.

7 And they also believe that's the same for
8 fire and internal events. And there is some data to
9 suggest that but there's kind of a need for more, more
10 data and more service to understand if that's, in
11 fact, the case.

12 Another uncertainty that was identified
13 was the bypass of internal flood barriers and the
14 internal fire barriers during certain plant operating
15 states. The experts acknowledged that happens.

16 It wasn't completely clear to them how
17 significant those bypasses are because in most cases,
18 if you take a bypass out of service, you're probably
19 accompanying that with some compensatory action.

20 So, they kind of wanted understand that
21 better, maybe a survey of plant practices regarding
22 bypasses and what really actually happens, and how
23 much do they compensate when they take something out
24 of service?

25 Another uncertainty was sort of this lack

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1 of thermal hydraulic analysis for conditions at low-
2 power that are unique from full power. And the
3 suggestion was maybe a risk-informed listing of
4 conditions that would benefit from thermal hydraulic
5 analysis and some MAAP analysis would be useful.

6 And all of them I think were similar to
7 these. Mainly, there are areas where they wish they
8 had more information. They could have done a better
9 job in the elicitation if they had more information.

10 So, the next slide is the main insights.
11 This slide shows that the primary insights are the
12 identification of plant operating states as the most
13 important as we've been talking about.

14 I don't know if there's too much more to
15 say. The plant operating states that lead into the
16 mid-loop and that end up being in that didn't really
17 surprise anyone.

18 CHAIR STETKAR: So, if I'm going to do a
19 low-power and shutdown study, those are the only plant
20 operating states that I need to worry about?

21 MR. COLES: I wouldn't say it that way. I
22 would say you want to include these at a minimum.

23 CHAIR STETKAR: Well, of course, I want to
24 include all of them because that's the only way that I
25 can understand the risk.

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1 MR. KURITZKY: Right, and so the chances
2 of this project or this task was if we had, just to
3 take this to the extreme, if we had only resources
4 available to focus on five plant operating states,
5 these are the five we would pick.

6 CHAIR STETKAR: Yes.

7 MR. KURITZKY: But we hope to have
8 resources to do more than five, but if we only have it
9 for five, these are the five we would pick.

10 CHAIR STETKAR: And if you were going to
11 do an informed risk assessment in the other plant
12 operating states, you would use simplified models and
13 conservative assumptions so that you have confidence
14 that you've captured the risk from those in perhaps a
15 conservative way, but not assign them 0 by not looking
16 at them.

17 So, I'm hoping that you did that.

18 MR. KURITZKY: Right, and so that's what
19 we had done in our study, and the point is, though,
20 you can do that and many people agree that's the way
21 to go.

22 But you just have to recognize that by
23 doing that, you are now taking away resources for how
24 well you're willing to do those five also. So, it's a
25 tradeoff.

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1 But I agree, generally you don't want to
2 just write something clearly off, as Dr. Bley said,
3 you don't want to assume that it's perfect. By not
4 including that, you're not actually saying that, it's
5 just your amount doesn't reflect that.

6 Because things like coronal mass ejection,
7 which we will have in our study, we don't do that
8 because we think it's not an issue.

9 In fact, we're concerned that maybe it is
10 more of an issue but we have no ability to treat it
11 right now so we rule it out. But it doesn't mean that
12 we don't believe that it's a concern.

13 So, just because you rule something out
14 doesn't mean you don't believe it's important. But it
15 doesn't get counted for and so you either need to do
16 some I know you don't like bounding but some kind of
17 simplified bounding analysis, or you have to just
18 recognize this could be important and you need to
19 state that.

20 If you take something out because you
21 think it's not important, state that, if you take
22 something out just because you don't --

23 MEMBER BLEY: And state it in a big clear
24 way so it's not missed.

25 MR. KURITZKY: Right, exactly, and if you

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1 think that because you don't have the resources but
2 you think it might be important or you don't have the
3 capability or the technology right now to address it,
4 make that very clear too.

5 That's the reason we're taking it out, not
6 just because we don't think it's important.

7 MEMBER BLEY: Quick comment, a question.
8 The kinds of things that came up in this brainstorming
9 session I think would have been very useful for a PIRT
10 with the right experts to dig into those and give you
11 some idea of what research was needed.

12 For me, the results of this pseudo-PRA
13 came out the way we would have expected without any
14 thinking about it from people who knew the plant.

15 So, I'm not sure you gain anything except
16 maybe you did in the plants-specific work and we're
17 having closed sessions on everything else.

18 Is there a reason you didn't share the
19 plant-specific stuff with us and do it in a closed
20 session and you gave us this instead?

21 MR. KURITZKY: The reason is because at
22 the time that study was completed, the internal part
23 of it, we had many other things that we had to discuss
24 with you.

25 So, again, it's just a question of how

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1 many we cram in the meeting.

2 MEMBER BLEY: Well, it was a lot effort to
3 sanitize this, I expect?

4 MR. KURITZKY: Yes.

5 MEMBER BLEY: I'm not sure what it gains.

6 MR. KURITZKY: The sanitation was
7 minuscule compared to the level of effort of the work,
8 I can see that clearly. But the point is this thing
9 came up by the time we had some openings on the agenda
10 so we could stick it in.

11 Back then, we did not and it was just a
12 question of what we had to report on at the time and
13 whether we could squeeze it into the agenda or not.

14 MEMBER BLEY: And just because we've
15 interrupted the flow, probably the main complaint I've
16 seen about AHP -- and I've not studied it in detail or
17 even done the exercises John talked about.

18 Lots of people I know in this area aren't
19 fans of it and most of them point to James Dyer who
20 you've probably read, who says it's a fraud procedure
21 for ranking alternatives because the rankings produced
22 by this procedure are arbitrary.

23 And it kind of smells like that to me but
24 I haven't dug into it enough but I think the Staff
25 ought to really understand those complaints before

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1 they make a major commitment to doing things this way
2 in the future.

3 CHAIR STETKAR: I wouldn't go so far as to
4 say arbitrary, I would say that the --

5 (Simultaneous Speaking.)

6 I understand. I still come back to I
7 think you need, if the Staff is going to endorse AHP
8 as an input to expert elicitations for PIRT, you
9 really need to go test the process on something that's
10 not as multi-variant as this example, but test the
11 process to see whether it subtly reinforces this knife
12 edge of importance versus chasms of unimportance, just
13 simply the way that people apply it.

14 And that's the biggest concern.

15 MEMBER BLEY: And I would say test it
16 against the SSHAC kind of process for getting a
17 consensus distribution on these issues and see how
18 that all turns out.

19 CHAIR STETKAR: He's got a slide and a
20 half to get to.

21 MR. COLES: So, real quickly now, the
22 bottom part of this slide talks about process
23 insights. So there are insights about the process
24 that were brought to us from the experts.

25 That first bullet says, and I think you

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1 referred it to earlier, Dennis, there's a value in
2 consulting with the expert Panel Members more
3 explicitly in the early stages.

4 And the reason we state that is because
5 one of the Panel Members brought up this point at the
6 group meeting I think about, you know, that low power
7 and shutdown regimes are kind of fundamentally
8 different and maybe we'd be served to do those
9 separately and it was a valid point.

10 But at that point in time, it was really
11 difficult to grapple with it. So, that's kind of why
12 we made that comment and at the same time, we did
13 interact quite a lot with the Members so it's a matter
14 of resources.

15 There may be a little bit more focus
16 there.

17 MEMBER BLEY: There's something about
18 having the experts interact as a group with you guys
19 that you don't get until, as you said, too late in the
20 process.

21 Not too late for them to understand each
22 other's opinions and maybe adjust their own scores but
23 too late to really restructure what you're doing.

24 MR. COLES: The second bullet there,
25 there's significant benefit in the trial process we

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1 did where we used the participatory peer reviewers as
2 the experts because I think we had the thought that we
3 could do this sort of in real time.

4 But when we tried to do it, it was
5 immediately obvious that was a little harder.

6 And we've ironed out a lot of logistics
7 doing that, and then as we've been talking, we did
8 identify that there's some pros and cons about where
9 to show the underlying computations.

10 So, we did end up showing them and we
11 debated whether we shouldn't or should. Our initial
12 thinking was, well, just let the forms drive the
13 process and we didn't want them -- yes, we were kind
14 of thinking we don't want them to dial in and answer
15 because they understand the underlying calculations.

16 But we get the other side of the coin too,
17 and in fact, we spent a couple hours on it during the
18 review.

19 CHAIR STETKAR: If I'm an expert and
20 you're asking me for my expert opinion and I don't
21 understand how I'm elaborating that numerically, you
22 say you didn't want the bias. Well, you're already
23 asking me for my expert opinion.

24 MR. COLES: Understood.

25 CHAIR STETKAR: And you're asking my

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1 friend over here for his expert opinion and you're
2 going to somehow aggregate those two. You might have
3 a much different opinion.

4 MR. COLES: So we did identify it as an
5 insight takeaway. The next slide is really the final
6 slide, and we've already talked about the first three
7 bullets.

8 So, the fourth bullet is another PRA low-
9 power shutdown modeling uncertainty, I'll just mention
10 it. The experts thought there was the lack of
11 enhanced HRA methodology.

12 I don't know if there's any HRA folks in
13 the room but to address the complexity of the human
14 actions associated with low-power shutdown, those
15 actions take it away from the main control room.

16 Most of the procedures or the methods that
17 we have are specifically focused on actions in the
18 main control room, right? So, that was something.

19 MEMBER BLEY: Was that uniform across your
20 PRA group?

21 MR. COLES: It must have been because it
22 made the listed 19 so that was a consensus list.

23 CHAIR STETKAR: That's just a sad
24 commentary on the state of affairs, Dennis.

25 MEMBER BLEY: Given the people on the

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1 list, yes, it is.

2 MR. COLES: And then that's really all I
3 had for slides.

4 MEMBER KIRCHNER: Would you go back to
5 Slide 11? Either I didn't understand it or there was
6 a mistake in the slide.

7 I don't think you took your upper left
8 state university rankings and used them when you did
9 the calculation in the bottom box.

10 MR. COLES: So, there's a mistake in the
11 slide?

12 MEMBER KIRCHNER: Yes.

13 MR. COLES: That's not unlikely.

14 MEMBER KIRCHNER: Well, and I don't want
15 to belabor it because that happens all the time to us
16 too. But it does result in the domestic, the
17 international, and the state universities coming out
18 almost with an identical answer.

19 And so I would either do one of two things
20 for instructional purposes. I'd either perturb the
21 slide to make one really stand out or I would then
22 elaborate and say that one fell off, which was the
23 college, and the other three are equally valid
24 alternatives or something.

25 But when you get an answer where

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1 everything comes out essentially the same, then people
2 say why go through this, this hasn't helped my
3 thinking at all. You might as well rely on intuition.

4 (Simultaneous Speaking.)

5 MR. KURITZKY: That was just a cut and
6 paste. Clearly, I don't know the slide but I can tell
7 that they cut and pasted from college to state and
8 forgot to change.

Because you could see from the table above
it, the states would have rankings but it's just cut
and paste.

12 MEMBER KIRCHNER: It's a minor point but
13 if you use it again, you'll want to fix it and draw
14 conclusions from it because --

15 MR. COLES: To illustrate how you can get
16 a different insight or something.

17 MEMBER KIRCHNER: Yes.

18 CHAIR STETKAR: This came out of the paper
19 and in the paper you do that distinction. Any other
20 questions? Alan, do you have anything to say as a
21 wrap-up?

22 MR. KURITZKY: No, not really. The input
23 we've got, we recognize some of the limitations and
24 whatnot and we appreciate the feedback.

25 CHAIR STETKAR: There's a couple things I

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1 need to do here, first of all because this ends our
2 public session for the day.

3 I'll ask if there's anyone in the room who
4 would like to make a comment, please come up to the
5 microphone, identify yourself, and make the comment.

6 While the stampede is coming up to the
7 microphone, I'll ask. Theoretically, the bridge line
8 should be open so if there's anyone --

9 MR. BROWN: The bridge is open.

10 CHAIR STETKAR: Thank you. If there's
11 anyone on the bridge line, a member of the public who
12 would like to make a comment, please identify yourself
13 and give us your comment.

14 MR. LEWIS: Marvin Lewis.

15 CHAIR STETKAR: Hello, Mr. Lewis.

16 MR. LEWIS: Hi.

17 CHAIR STETKAR: It's all yourself, you
18 have the floor.

19 MR. LEWIS: Thank you.

20 As a member of the public, I listen to
21 this and I remember back to Rasmussen, back in the
22 '60s I think it was, and how he pointed out that these
23 numbers have to be magical for the public to accept
24 them.

25 Maybe, I don't know, but my question's a

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1 little closer to today. Mainly, somebody there
2 specified that it took a while to explain to the
3 experts how to use the forms, how to fill in the
4 forms.

5 So that's reasonable but my problem is
6 this: were you just explaining how to fill in the
7 forms or were you explaining how to fill in the forms
8 so that you got the answers you wanted?

9 Thank you.

10 CHAIR STETKAR: Thank you. Any other
11 comments from members of the public? If so, please
12 speak up, identify yourself.

13 Hearing none -- that's my microphone -- as
14 we usually do, I'll go around the table and ask each
15 of the Members if they have any final comments and
16 I'll start with Vesna.

17 MEMBER DIMITRIJEVIC: It's a different
18 side.

19 CHAIR STETKAR: I'd like to keep you on
20 your toes.

21 MEMBER DIMITRIJEVIC: So, I'm new here and
22 all of you have two PRAs which ask you a lot of
23 questions. I have ten times more divide in that
24 because it will take us forever but I'm new so I'm
25 learning the things.

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1 My high-level comment was that when I look
2 in your report which was the PRA modeling priority, I
3 was expecting something different inside.

4 Because it was expecting that you will
5 address issues which we have a problem when we do PRA
6 in shutdown, the things which are not well-known and
7 the standards or something.

8 But this is a very high-level risk
9 prioritization which will be more maybe advice on how
10 to do your shutdown schedule or something.

11 It's not really the PRA model in priority
12 and some things which are important in the PRA, Joy
13 addressed this, like we don't know what the system set
14 out for maintenance and how does this address the POS
15 risk?

16 POS risk is addressed purely from the
17 thermal hydraulic point of view, not what kind of the
18 main things is done in that risk.

19 So, it was a little disappointed and I
20 wasn't sure I should be calling this PRA modeling
21 priority or it should be some different title, but of
22 course, we've had some interesting information.

23 Because also you said that it's interesting that
24 you did the shutdown study before this was done so you
25 said you didn't take anything out because of it but

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1 you didn't add anything in because of that and you
2 probably saw your own risk insights, what Joy was
3 bringing up, in your studies.

4 So you could compare that to what you're
5 seeing in that PRA paper. But I'm not really sure
6 would that really be necessary? All right, so this is
7 my high-level comment.

8 CHAIR STETKAR: Thank you. Walt?

9 MEMBER KIRCHNER: No further comments,
10 thank you all.

11 CHAIR STETKAR: Jose?

12 MEMBER MARCH-LEUBA: No further comments.

13 CHAIR STETKAR: Dennis?

14 MEMBER BLEY: I've said everything I meant
15 to say except I'm a little annoyed in studies like
16 this that refer to the history of how this evolved
17 that the original study that was an EPRI report on
18 this wasn't included.

19 (Laughter)

20 CHAIR STETKAR: Oh, whine, whine, whine.

21 MEMBER BLEY: There's a tendency not
22 invented here that permeates the Agency a little too
23 often I think.

24 CHAIR STETKAR: Ron?

25 MEMBER BALLINGER: No further comment.

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1 CHAIR STETKAR: And I don't have anything
2 either, thanks a lot.

3 You covered an awful lot of ground this
4 morning and fielded an awful lot of questions. I
5 appreciate your candor and feedback.

6 And with that, we are recessed and I'm
7 going to ask Members to come back at 1:15 p.m. please?

(Whereupon, the above-entitled matter
went off the record at 12:28 p.m.)

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Full-Scope Site Level 3 PRA

Advisory Committee on Reactor Safeguards
Reliability and PRA Subcommittee

May 2, 2018
(Open Session)

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Outline

- Open Session
 - Project status overview
 - LPSD PIRT NUREG/CR
- Closed Session
 - Level 2 PRA
 - Internal fires, seismic events, high winds
 - Shutdown
 - Future interactions



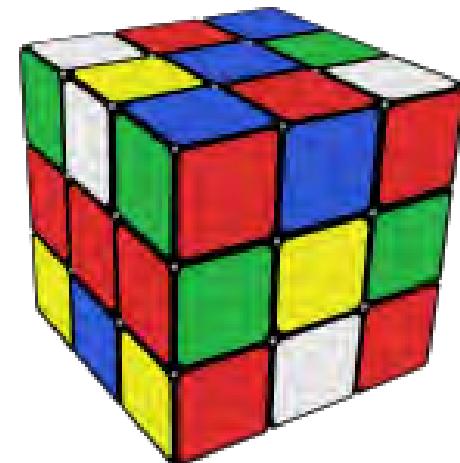
Level 3 PRA Project Status Overview

May 2, 2018

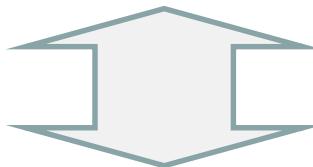
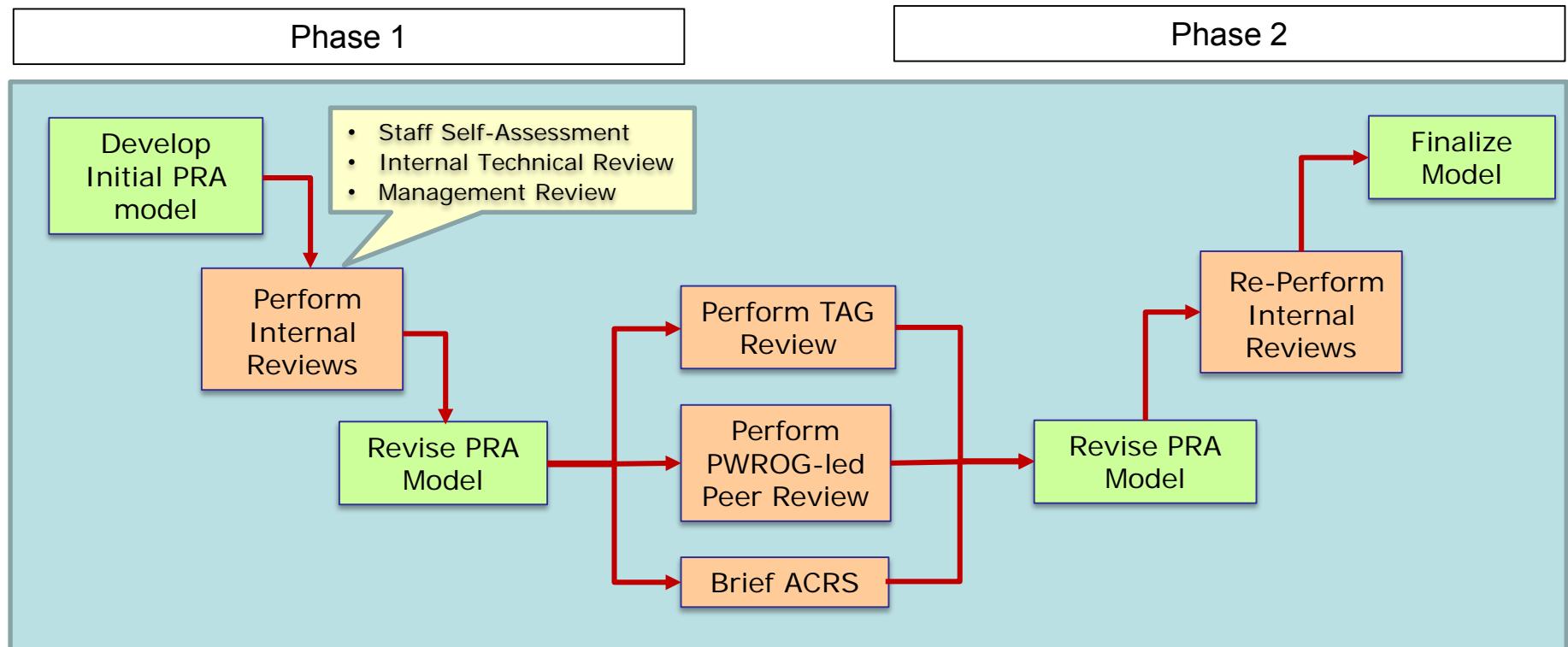
Alan Kuritzky
Division of Risk Analysis
Office of Nuclear Regulatory Research
(301-415-1552, Alan.Kuritzky@nrc.gov)

Outline of Presentation

- Reactor, at-power, internal events and floods
- Reactor, at-power, internal fires and seismic events
- Reactor, at-power, high winds and other hazards
- Reactor, low power and shutdown
- Spent fuel pool
- Dry cask storage
- Integrated site
- Path Forward



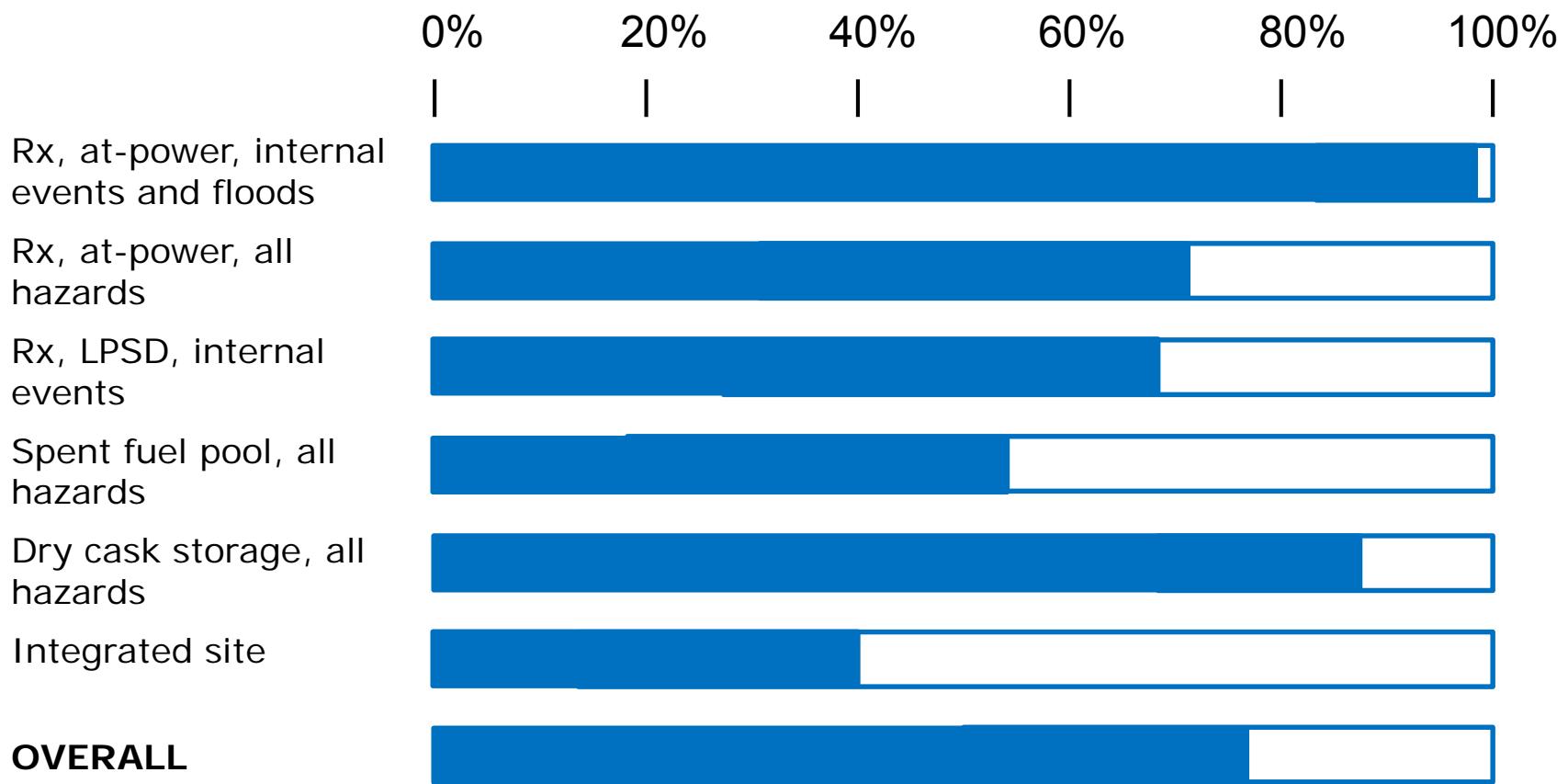
Generic Process for PRA Model Development



Develop Documentation

Project Status

Combined status of model development, project reviews, and project documentation



Reactor, At-Power, Internal Events and Floods

- Completed ASME/ANS PRA standard-based peer review of Level 1, 2, and 3 PRAs, led by PWR Owners Group
- Completed substantive update to Level 1, 2 and 3 PRAs to address peer review and other comments
 - Level 1 internal events and Level 2 internal events and floods (Phase 2) finalized
 - Level 1 internal floods (Phase 2) virtually complete
 - Level 3 internal event and flood PRA report (Phase 2) being finalized (prior to internal technical review)
- Completed expert elicitation for interfacing systems LOCA

Reactor, At-Power, Internal Fires and Seismic Events

- Completed initial revision of Level 1 fire and seismic PRA models and documentation based on new input from utility
- Both models and documentation have been updated to incorporate internal technical review comments
- Revised fire PRA (Phase 1) is undergoing project management review; revised seismic PRA (Phase 1) is in the queue for project management review
- Level 2 modeling for internal fires and seismic events (Phase 1) is close to completion
 - Uncertainty analysis
 - Self-assessment

Reactor, At-Power, High Winds and Other Hazards

- Completed ASME/ANS PRA standard-based peer review, led by PWROG
- Level 1 high wind PRA (Phase 2) finalized
- Completed substantive update to “Other Hazards” report to address peer review and other comments
 - Phase 2 report currently undergoing final project management review

Reactor, Low Power and Shutdown

- Completed initial LPSD Level 1 PRA model for internal events
 - Currently undergoing project management review
- Level 2 PRA for LPSD (Phase 1) close to completion
 - Uncertainty analysis
 - Self-assessment
- Performed a Phenomena Identification and Ranking Technique (PIRT) expert elicitation to identify ranked list of focus areas for LPSD PRA
 - Contractor report finalized (contains proprietary information)
 - Completed draft of NUREG/CR (for public release)

Spent Fuel Pool PRA

- Level 1 analysis is nearly complete for all of the initiating events under consideration
 - Recently added new scenarios considering combinations of events
- Level 2 analysis ongoing
 - MELCOR runs largely complete
 - Level 2 event tree under development
- Continuing work includes:
 - Human reliability analysis: method has been defined and has been exercised for most events of interest
 - Documentation is ongoing

Dry Cask Storage PRA

- Completed initial Level 1/2/3 model and documentation for all hazards
- Revised consequence analysis to be site-specific
- Completed internal technical review (NMSS)
- Currently undergoing project management review

Integrated Site PRA

- Developed an approach for an integrated site PRA model using single-source PRA model results and risk insights to prioritize the systematic identification and modeling of multi-source accident scenarios and inter-source dependencies
- To provide additional confidence that potentially important multi-source accident scenarios are not missed, this approach is coupled with the use of systematic techniques to search for and prioritize potential multi-source accident scenarios that may not be captured by relying only on results and insights from individual single-source PRA models.
- Completed pilot applications of the approach for:
 - Reactor Units 1 & 2, at-power, internal events, Level 1 PRA
 - Reactor Units 1 & 2, at-power, internal events and floods, Level 2 PRA
 - Reactor Units 1 & 2, at-power, seismic events, Level 1 PRA
 - Reactor Units 1 & 2, at-power, internal fires, Level 1 PRA
 - Reactor Units 1 & 2, internal events, Level 1 PRA, one unit operating and one unit shut down

Key Upcoming Milestones

- Complete updated reactor, at-power, other hazards report (May 2018)
- Reactor, at-power, Level 1, internal fire PRA ready for TAG review (May 2018)
- Reactor, LPSD, Level 1, internal event PRA ready for TAG review (May 2018)
- Dry cask storage, Level 1, 2, and 3 PRA ready for TAG review (June 2018)
- Reactor, at-power, Level 1, seismic event PRA ready for TAG review (June 2018)
- Reactor, at-power, Level 2, fire and seismic PRA ready for TAG review (September 2018)
- Reactor, LPSD, Level 2, internal event PRA ready for TAG review (September 2018)

Acknowledgements

- SNC
- PWR Owners Group
- Westinghouse
- EPRI
- NSIR, NRO, NRR, NMSS, Regions, TTC
- National Laboratories (INL, SNL, PNNL, BNL)
- Commercial Contractors (ERI, ARA, IESS)
- ACRS

Acronyms and Definitions

ACRS	Advisory Committee on Reactor Safeguards
ANS	American Nuclear Society
ARA	Applied Research Associates
ASME	American Society of Mechanical Engineers
BNL	Brookhaven National Laboratory
EPRI	Electric Power Research Institute
ERI	Energy Research, Inc.
IESS	Innovative Engineering & Safety Solutions, LLC
INL	Idaho National Laboratory
LOCA	Loss of coolant accident
LPSD	Low power and shutdown
PIRT	Phenomena Identification and Ranking Technique
PNNL	Pacific Northwest National Laboratories
PRA	Probabilistic risk assessment
PWR	Pressurized-water reactor
PWROG	PWR Owners Group
Rx	Reactor
SNC	Southern Nuclear Operating Company
SNL	Sandia National Laboratories
TAG	Technical Advisory Group



Draft NUREG/CR-XXXX

Phenomenon Identification and Ranking Technique (PIRT)

Low-Power / Shutdown PRA Modeling Priorities

Advisory Committee on Reactor Safeguards
Reliability and PRA Subcommittee

May 2, 2018
(Open Session)

Jeff Wood
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Motivation for PIRT Project

- Apply PIRT to Low-Power / Shutdown (LPSD) PRA Modeling Priorities
 - Recognized challenges with LPSD PRA scope
 - PIRT – Systematic process to incorporate expert judgment into ranking important phenomena, systems, components, and processes
- Exercise Expert Judgment Process
 - Response to SRM-SECY-11-0172 (ADAMS ML121420096): Pilot draft guidance on using expert judgment in the Level 3 PRA Project
 - Application of the Analytical Hierarchy Process (AHP)*
- Document Expert Judgment Process

* Saaty, T.L. 2008. "Decision Making with the Analytical Hierarchy Process," International Journal of Services Sciences, Volume 1, Issue 1, pp. 83–98.

Outcomes of PIRT for LPSD PRA Modeling Priorities

- Ranking results of LPSD plant operating state priorities
 - Results not available in time to influence L3PRA Project LPSD PRA modeled scope
 - Early interactions with augmented Technical Advisory Group (TAG) provided input to L3PRA Project LPSD PRA model
- Brainstorming session on LPSD PRA modeling issues
 - Experts provided many thoughts and observations that were not directly related to PIRT process
 - Identified areas where additional study may be needed
- Detailed documentation of expert elicitation process and application of AHP



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PIRT for Determination of Low Power Shutdown PRA Priorities

Presentation to ACRS Subcommittee on Reliability and Probabilistic Risk Assessment

May 02, 2018

Garill Coles*
Steve Short*
Amanda White
Mike Toyooka

Pacific Northwest National Laboratory (PNNL)

What is a PIRT?

- ▶ Phenomena Identification and Ranking Technique (PIRT)
A systematic way to gather information from experts about identification of important nuclear power plant systems, components, processes, and phenomena and to rank them according the decision that needs to be made (Diamond 2006, Wilson and Boyack 1998)
- ▶ PIRT has been successfully applied to several applications by NRC (e.g., NUREG/CRs 6742, 6743, 6744, 6764, and NUREG 7150)
- ▶ Here PIRT was used to identify important elements of a Low-Power Shutdown (LPSD) PRA

Diamond, D.J.. September 2006. "Experience Using Phenomena Identification and Ranking (PIRT for Nuclear Analysis," BNL-76750-2006-CP, Brookhaven National Laboratory, Upton, New York.

Wilson, G.E., and Boyack. B.E. November 1998. "The role of the PIRT process in experiment, code development and code applications associated with reactor safety analysis," *Nuclear Engineering and Design*, Vol. 186, Issues 1-2, pp 23-37

Expert Panel Members

Name	Current Company	Experience
Ken Kiper	Westinghouse Electric Company	LPSD PRA, 30+ years experience
Jeff Julius	Jensen Hughes	LPSD PRA, 30+ years experience
Don Wakefield	ABSG Consulting Inc.	LPSD PRA, 40+ years experience
Jeff Mitman	NRC	LPSD PRA (including thermal-hydraulics success criteria)
Marie Pohida	NRC	LPSD PRA (including thermal-hydraulics success criteria)
Jim Ledgerwood	Westinghouse Electric Company	Nuclear operations and outage management, 30 years experience
Stephen Prewitt	Consultant	Nuclear operations and management at the reference plant, 30+ years experience

Participatory Peer Reviewers



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Name	Current Company	Experience
Jeff Wood	NRC	LPSD PRA, PRA research
Jing Xing	NRC	Expert elicitation, human factors

Purpose of LPSD PRA PIRT Elicitation Project

- ▶ A comprehensive assessment of LPSD risk would be extremely challenging given the number of plant operating states (POSSs), outage types, and potential hazards
- ▶ The purpose of the PIRT exercise was to:
 - Identify the POSSs and outage types, and important hazards for a plant
 - And rank these according to their importance to LPSD risk,
 - While considering important influences/phenomena associated with LPSD
- ▶ The scope was limited to activities while the fuel is in the reactor pressure vessel
- ▶ Important influences/phenomena associated with LPSD in the ranking process were either:
 - Identified explicitly as evaluation criteria used in the PIRT or
 - Identified as contributing to LPSD PRA sensitivity or uncertainty



Consideration of SSHAC Principles

- ▶ The project considered the following SSHAC* principles in putting together the LPSD PRA PIRT process
 - Structured process to facilitate elicitation and minimize biases
 - Breadth of State-of-Knowledge – Evaluation of available data, balance of expertise
 - Independence – Judgment based on knowledge and individuals' expertise
 - Interaction in evaluating models/data and assessing uncertainties
 - Integration (rather than consensus) of interpretations / judgment
- ▶ Four training sessions helped ensure the experts understood the stated problems and LPSD PRA PIRT process
- ▶ Feedback from participatory peer reviewers who monitored the elicitation process helped create a well-defined process that avoided motivational and cognitive biases

*NUREG2117, Revision 1, Practical Implementation Guidelines for SSHAC Level 3 and 4 Hazard Studies" - Provides guidance about the manner in which the uncertainties in probabilistic seismic hazard analysis (PSHA) should be addressed using expert judgment and has become known as the "SSHAC process"



Steps of the PIRT Process

1. Prepare Detailed Problem Statement

2. Create PIRT Evaluation Team

3. PIRT Process Familiarization Meetings

4. Solicit Input from Experts on PIRT Parameters

5. Individual PIRT Elicitation Meetings

6. Group PIRT Elicitation Meeting

7. Analysis of Results and Report

Incorporation of Analytical Hierarchy Process (AHP) into the PIRT Process

- ▶ Endorsement for use of AHP in the PIRT process
 - Wilson and Boyack in their 1998 article in Nuclear Engineering and Design stated regarding PIRT that AHP is a highly recommended way to formalize a product to be defensible, scrutinizable and complete (though it requires more work)
- ▶ Yet we did not find that the AHP has been used in a PIRT
- ▶ PNNL notes that, in general, since the AHP was developed in the 1980s, it has been well used and studied.
- ▶ PNNL considers use of the AHP beneficial because
 - Pair-wise comparisons are intuitive and practical to perform
 - Use of explicit evaluation criteria contributes to transparency and completeness
 - The natural outcome of the AHP is a ranking of alternatives



Brief Discussion on How the AHP Works

Goal:

Select the best job

Criteria:

Criteria #1

Criteria #2

Criteria #3

Criteria #4

Criteria #5

Alternatives:

Alt #1

Alt #2

Alt #3

Alt #4

Criteria:

- 1 – Flexibility
- 2 – Opportunity
- 3 – Security
- 4 – Reputation
- 5 - Salary

Alternatives:

- 1 – Domestic Company
- 2 – International Company
- 3 – College
- 4 – State University



Brief Discussion on How the AHP Works

Column A	Pairwise Comparison of Evaluation Criteria						
Row B	Flexibility	Opportunity	Security	Reputation	Salary	Totals	Normalized Priorities
Flexibility	1	.14	.25	.11	.11	1.61	0.03
Opportunity	7	1	4	.50	1	13.5	0.25
Security	9	2	1	.25	.5	12.75	0.23
Reputation	4	.25	4	1	.25	9.5	0.17
Salary	9	1	4	2	1	17	0.31
Total						54.36	1.00

Importance of Criterion listed in Column A versus Row B		
Comparison Category	Definition	Importance Ratio
A	Exceptionally more important	9
B	Strongly more important	7
C	Moderately more important	4
D	Slightly more important	2
E	Equally important	1
F	Slightly less important	1/2
G	Moderately less important	1/4
H	Strongly less important	1/7
I	Exceptionally less important	1/9



Brief Discussion on How the AHP Works

Ranking of Alternatives

ALTERNATIVES	EVALUATION CRITERIA				
	Flexibility	Opportunity	Security	Reputation	Salary
Domestic Company	H	M	M	M	H
International Co.	H	H	L	H	M
College	M	L	H	L	L
State University	L	M	H	H	M

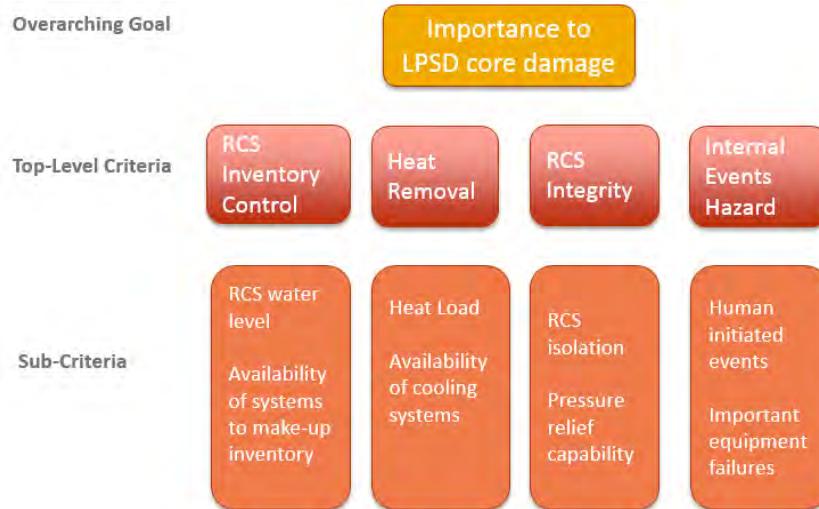
Pair-wise Comparison of Ranking Weights Salary Criteria						
Level at Which Criterion is Met	H	M	L	Totals	Normalized Weights	Idealized Weights
High (H)	1	7	9	17	0.72	1
Moderate (M)	0.14	1	4	5.14	0.22	0.3
Low (L)	0.11	0.25	1	1.36	0.06	0.08
Total				15.73	1	

Importance Ranking of Alternative – Best Job							
	Flexibility	Opportunity	Security	Reputation	Salary	Importance Total	Normalized Importance
	0.03	0.25	0.23	0.17	0.31		
Domestic Company	H	M	M	M	H		
	(0.03*1.00)	(0.25*0.30)	(0.23*0.30)	(0.17*0.30)	(0.31*1.00)	0.54	0.32
International Company	H	H	L	H	M		
	(0.03*1.00)	(0.25*1.00)	(0.23*0.08)	(0.17*1.00)	(0.31*0.30)	0.56	0.33
College	M	L	H	L	L		
	(0.03*0.30)	(0.25*0.08)	(0.23*1.00)	(0.17*0.08)	(0.31*0.08)	0.30	0.18
State University	M	L	H	L	L		
	(0.03*0.30)	(0.25*0.08)	(0.23*1.00)	(0.17*0.08)	(0.31*0.08)	0.30	0.18
Total						1.69	1.00



AHP Hierarchies Developed for the PIRT

Importance to core damage due to internal events

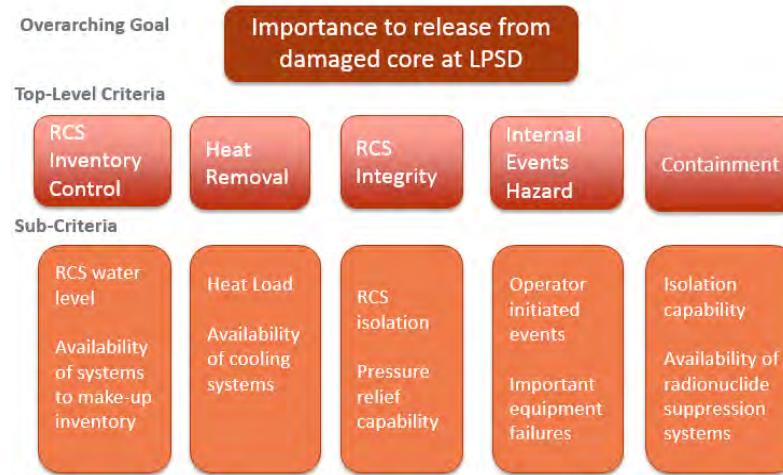


1. Importance to core damage due to internal events
2. Importance to release from damaged core due to internal events
3. Importance to core damage due to internal fire events
4. Importance to release from damaged core due to internal fire events
5. Importance to core damage due to internal flooding events
6. Importance to release from damaged core due to internal flooding events
7. Importance to core damage due to seismic events
8. Importance to release from damaged core due to seismic events



AHP Hierarchies Developed for the PIRT

Importance to release from damaged core due to internal events



- What is the heat load (of the POS) from power, decay heat, and RCS temperature?
- What is the level of vulnerability (of the POS) to maintaining RCS isolation?
- What is the time required (during a POS) to close containment versus time available?
- What is the level of opportunity (during a POS) for accident sequences initiated by human errors?
- What is the availability of reactor cooling systems (during the POS)?

PIRT Elicitation Sessions - Individual



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- ▶ In preparation for the Individual PIRT Elicitation sessions
 - Two trial sessions using participatory peer reviewers as substitute experts were performed to test the design of the PIRT process and the elicitation forms.
 - A set of written PIRT elicitation instructions was developed to support the experts and facilitate consistency
 - A facilitator checklist was developed
- ▶ Individual PIRT Elicitation sessions (2-hour sessions)
 - Started with explanation about the intent of each form and instructions for filling them out
 - General instruction and warnings about the potential for specific kinds of motivational and cognitive biases were provided
 - The experts were provided specific examples for how each type of form would be filled out
 - The facilitator probed to establish that the intent of the form was clear
 - The experts were given a week to finish and transmit the forms



Forms Used to Implement Expert Elicitation for the PIRT – Top Level Criteria Weights

Types of Forms

1. The relative importance of the top level evaluation criteria against each top level goal;
2. The relative importance of the sub-criteria against the top level criteria to which they apply;
3. Definitions of the ranking categories that define the level at which the evaluation sub-criteria are met (i.e., High, Moderate or Low);
4. The relative importance of the ranking categories associated with the sub-criteria to each other; and
5. Assignment of a ranking category to each POS.

TLC1	
Internal Events Core Damage Top-Level Criteria Elicitation Form	
Pair-wise Comparison of Two Criteria (X and Y)	
RCS Inventory Control	is more important than Heat Removal
Heat Removal	is more important than RCS Inventory Control
RCS Inventory Control	is more important than RCS Integrity
RCS Integrity	is more important than RCS Inventory Control
RCS Inventory Control	is more important than Internal Events Hazard
Internal Events Hazard	is more important than RCS Inventory Control
Heat Removal	is more important than RCS Integrity
RCS Integrity	is more important than Heat Removal
Heat Removal	is more important than Internal Events Hazard
Internal Events Hazard	is more important than Heat Removal
RCS Integrity	is more important than Internal Events Hazard
Internal Events Hazard	is more important than RCS Integrity

TLC2	
Internal Events Release Top-Level Criteria Elicitation Form	
Comparison Result (Enter A, B, C, D, or E in just one of the two rows for each pair-wise criteria)	
Pair-wise Comparison of Two Criteria (X and Y)	
RCS Inventory Control	is more important than Heat Removal
Heat Removal	is more important than RCS Inventory Control
RCS Inventory Control	is more important than RCS Integrity
RCS Integrity	is more important than RCS Inventory Control
RCS Inventory Control	is more important than Internal Events Hazard
Internal Events Hazard	is more important than RCS Inventory Control
RCS Inventory Control	is more important than Containment Performance
Containment Performance	is more important than RCS Inventory Control
Heat Removal	is more important than RCS Integrity
RCS Integrity	is more important than Heat Removal
Heat Removal	is more important than Internal Events Hazard
Internal Events Hazard	is more important than Heat Removal
Heat Removal	is more important than Containment Performance
Containment Performance	is more important than Heat Removal
RCS Integrity	is more important than Internal Events Hazard
Internal Events Hazard	is more important than RCS Integrity
RCS Integrity	is more important than Containment Performance
Containment Performance	is more important than RCS Integrity
Internal Events Hazard	is more important than Containment Performance
Containment Performance	is more important than Internal Events Hazard

Scale	Scale Definition
A	Criteria X and Criteria Y "equally" important
B	Criteria X "slightly" more important than Criteria Y
C	Criteria X "moderately" more important than Criteria Y
D	Criteria X "strongly" more important than Criteria Y
E	Criteria X "exceptionally" more important than Criteria Y



Forms Used to Implement Expert Elicitation for the PIRT – Sub-criteria Weights

SC1			
Sub-Criteria Elicitation Form			
Top-Level Criteria	Pair-wise Comparison of Two Sub-Criteria (X and Y)	Comparison Result [Enter A, B, C, D, or E in just one of the two rows for each pair-wise sub-criteria comparison]	Expert Comments
RCS Inventory Control	RCS Water Level is more important than Availability of Systems to Make-up Inventory Availability of Systems to Make-up Inventory is more important than RCS Water Level		
Heat Removal	Heat Load is more important than Availability of Reactor Cooling Systems Availability of Reactor Cooling Systems is more important than Heat Load		
RCS Integrity	RCS Isolation is more important than RCS Pressure Relief Capability RCS Pressure Relief Capability is more important than RCS Isolation		
Internal Events Hazard	Human Initiated Errors is more important than Important Equipment Failures Important Equipment Failures is more important than Human Initiated Errors		
Containment Performance	Containment Isolation Capability is more important than Availability of Radionuclide Suppression Systems Availability of Radionuclide Suppression Systems is more important than Containment Isolation Capability		
Fire Hazard	Fire Frequency is more important than Vulnerability to Fire Damage Vulnerability to Fire Damage is more important than Fire Frequency		
Internal Flooding Hazard	Internal Flooding Frequency is more important than Vulnerability to Internal Flooding Damage Vulnerability to Internal Flooding Damage is more important than Internal Flooding Frequency		
Seismic Hazard	Seismic Frequency is more important than Vulnerability to Seismic Damage Vulnerability to Seismic Damage is more important than Seismic Frequency		

Scale	Scale Definition
A	Criteria X and Criteria Y "equally" important
B	Criteria X "slightly" more important than Criteria Y
C	Criteria X "moderately" more important than Criteria Y
D	Criteria X "strongly" more important than Criteria Y
E	Criteria X "exceptionally" more important than Criteria Y



Forms Used to Implement Expert Elicitation for the PIRT – Sub-Criteria Ranking Categories

SCR4		
Availability of Reactor Cooling Systems Sub-Criteria Ranking Elicitation Form		
Evaluation Question: What is the availability of reactor cooling systems?		
Pair-wise Comparison of Two Categories (X and Y)	Comparison Result [Enter A, B, C, D, or E for each pair-wise category comparison]	Expert Comments
Not Very Available is more important than Available		
Not Very Available is more important than Very Available		
Available is more important than Very Available		

Ranking Category	Category Definition by Expert
Not Very Available	
Available	
Very Available	

Example definition by one expert:

Not Very Available: Single train of RHR and support systems available

Available: Both trains of RHR and support systems available

Very Available: SG Cooling – RCS intact and at least 2 SGs full

Scale	Scale Definition
A	Criteria X and Criteria Y "equally" important
B	Criteria X "slightly" more important than Criteria Y
C	Criteria X "moderately" more important than Criteria Y
D	Criteria X "strongly" more important than Criteria Y
E	Criteria X "exceptionally" more important than Criteria Y



Forms Used to Implement Expert Elicitation for the PIRT – POS Ranking

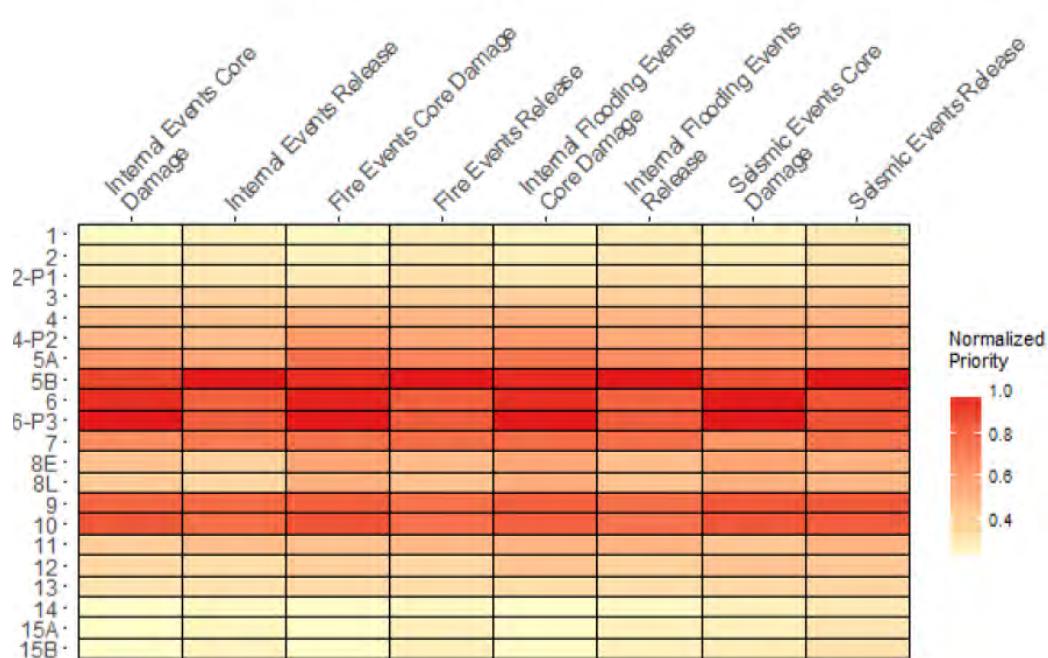
Plant Operating State (POS) Importance Ranking Elicitation Form (PR1)								
POS		Evaluation Criteria Rank						
No.	Description	Heat Load	Availability of Systems to Make-up RCS Inventory	RCS Water Level	Availability of Reactor Cooling Systems	RCS Isolation	RCS Pressure Relief Capability	Human Initiated Errors
		SCR3	SCR2	SCR1	SCR4	SCR5	SCR6	SCR7
		High Load (H) Medium Load (M) Low Load (L)	Not Very Available (H) Available (M) Very Available (L)	Low Water Level (H) Medium Water Level (M) High Water Level (L)	Not Very Available (H) Available (M) Very Available (L)	Not Very Available (H) Available (M) Very Available (L)	Very Vulnerable (H) Vulnerable (M) Normal (L)	High Opportunity (H) Moderate Opportunity (M) Low Opportunity (L)
3	Cooldown with RHR system to 200°F	M	H	M	L	L	M	L
4	Cooldown to ambient temperature with RHR only	M	H	M	M	M	M	M
4-P2	Cooldown to ambient temperature with RHR only	M	H	M	M	M	M	H
5A	Pressurizer water solid for hydrogen degassing	M	M	L	M	M	H	H

PIRT Elicitation Sessions - Group

- ▶ Group PIRT Elicitation session (3-day meeting)
 - The aggregate and individual results from the Individual PIRT Elicitation sessions were reviewed (differences between experts were highlighted)
 - Refinements were made to the PIRT elicitation forms based on specific recommendations of the experts
 - For each specific form each expert described the basis for how they filled out the form and received feedback from the other experts
 - Each expert recorded on their form (or in their notes) changes they intended to make based on the group discussions
 - The experts were given a week to finish and return the forms
- ▶ Brainstorming Session of LPSD PRA Modeling Uncertainties (during the 3-day meeting)
 - Issues not explicitly addressed by the LPSD PIRT
 - Issues primarily related to assumptions made, state of art PRA practice, and lack of information

- ▶ The primary results are the POS priorities for each top level goal and are presented as plots of the following:
 - Aggregated and individual POS priorities for the eight top level goals;
 - Aggregated and individual POS sub-criteria importance weights for each top level goal;
- ▶ PNNL also provided results on differences between experts
 - Evaluation criteria importance weights for top level criteria for each expert for each top level goal;
 - Sub-criteria importance weights for each expert for each top level criterion; and
 - Agreement in assignment of sub-criteria ranking categories to POSs between experts.
- ▶ Identified sources of uncertainty in the PIRT process
- ▶ Uncertainty issues associated with LPSD PRA identified by the experts

LPSD PRA PIRT Results



The Aggregated LPSD PRA PIRT Results by All Top Level Goals

- Defined in term of the four hazards considered (i.e., Internal Events, Internal Fire events, Internal Flooding, and Seismic Events), and
- In terms of core damage and release from a damaged core

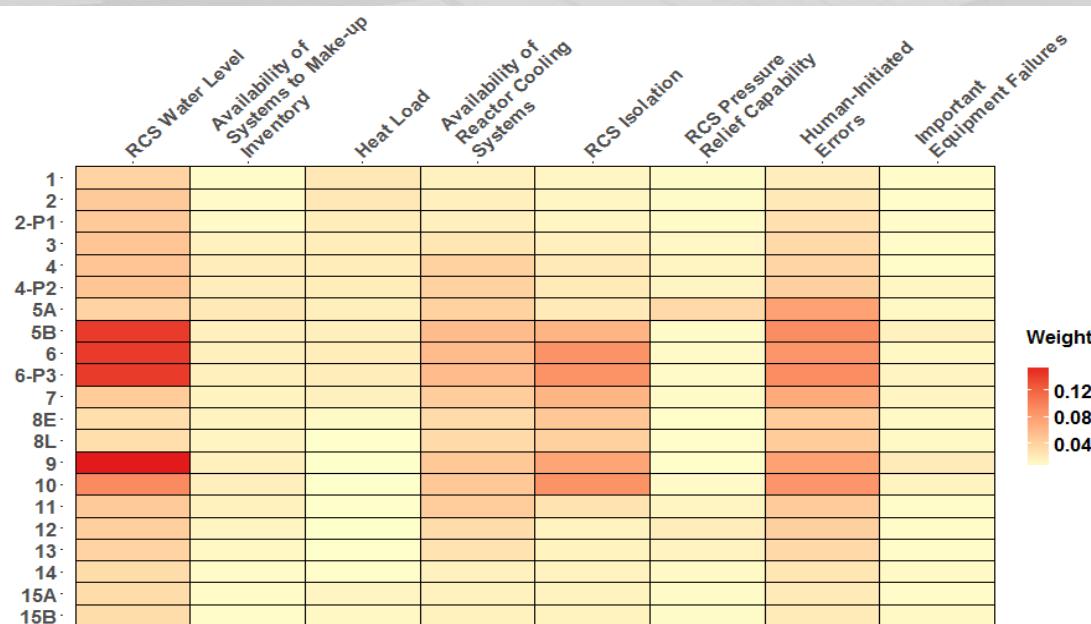
POS No.	Description
1	Low power and reactor shutdown
2	Cooldown with SGs to 350 °F
2-P1	Cooldown with SGs to 350 °F (P1)
3	Cooldown with RHR system to 200 °F
4	Cooldown to ambient temperature with RHR system only
4-P2	Cooldown to ambient temperature with RHR system only (P2)
5A	Pressurizer water solid for hydrogen degassing
5B	Draining the RCS level to flange
6	Mid-loop operation
6-P3	Mid-loop operation (P3)
7	Filling refueling cavity for refueling
8E	Refueling operation (OLD CORE)
DF	DEFUELED
8L	Refueling operation (NEW CORE)
9	Draining the RCS to mid-loop after refueling
10	Mid-loop operation after refueling
11	Refill RCS
12	RCS heatup/draw bubble in pressurizer
13	RCS system heatup to 350 °F
14	Startup with SG (AFW) to Hot Standby
15A	Reactor startup and LP operation <5%
15B	Reactor startup and LP operation >5 and <50%

LPSD PRA PIRT Results



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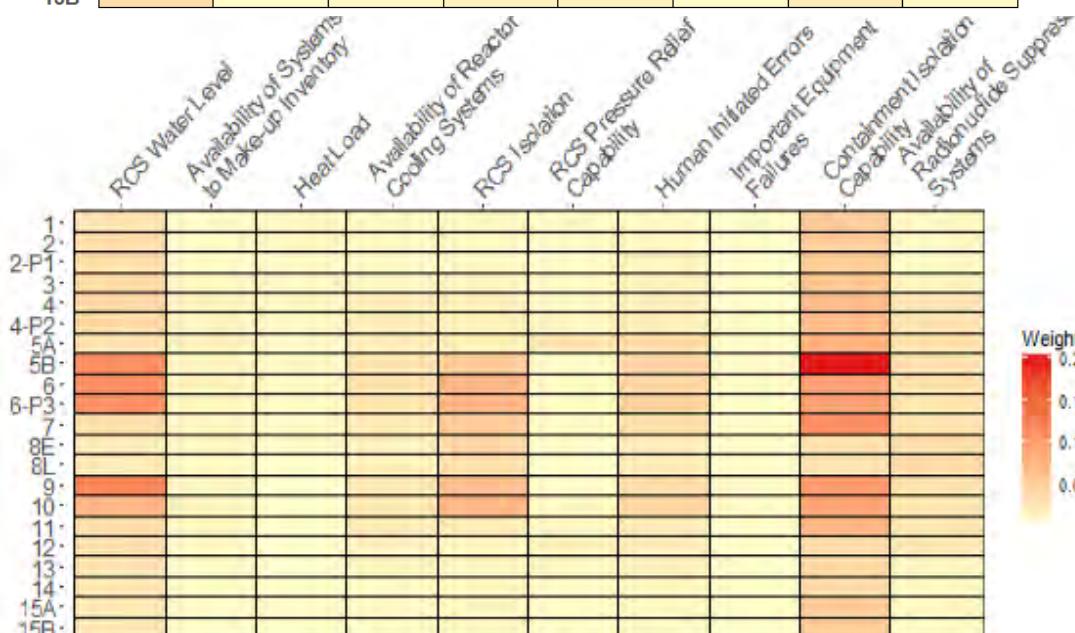
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Weight
0.12
0.08
0.04

The Aggregated LPSD PRA PIRT Results by Sub-criteria Importance

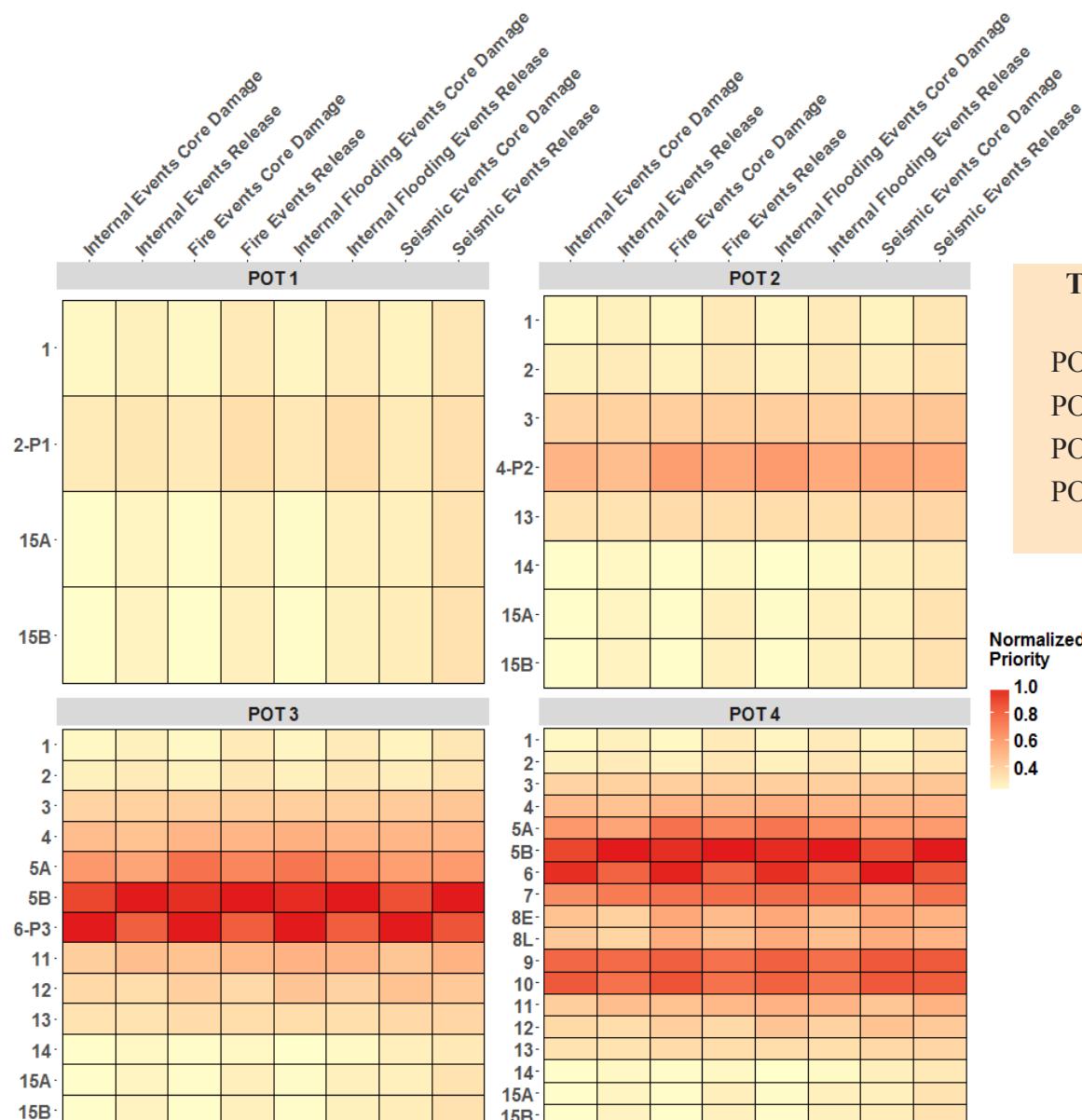
- Top figure – Sub-criteria weight for importance to core damage due to internal events
- Bottom figure - Sub-criteria weight for importance to release from a damaged core due to internal events
- The results for the other hazards were similar. Factors like RCS water level and RCS isolation stayed relatively more important for all top level goals
- The vulnerability of the POS to the hazard was important for all hazards



Weight
0.20
0.15
0.10
0.05



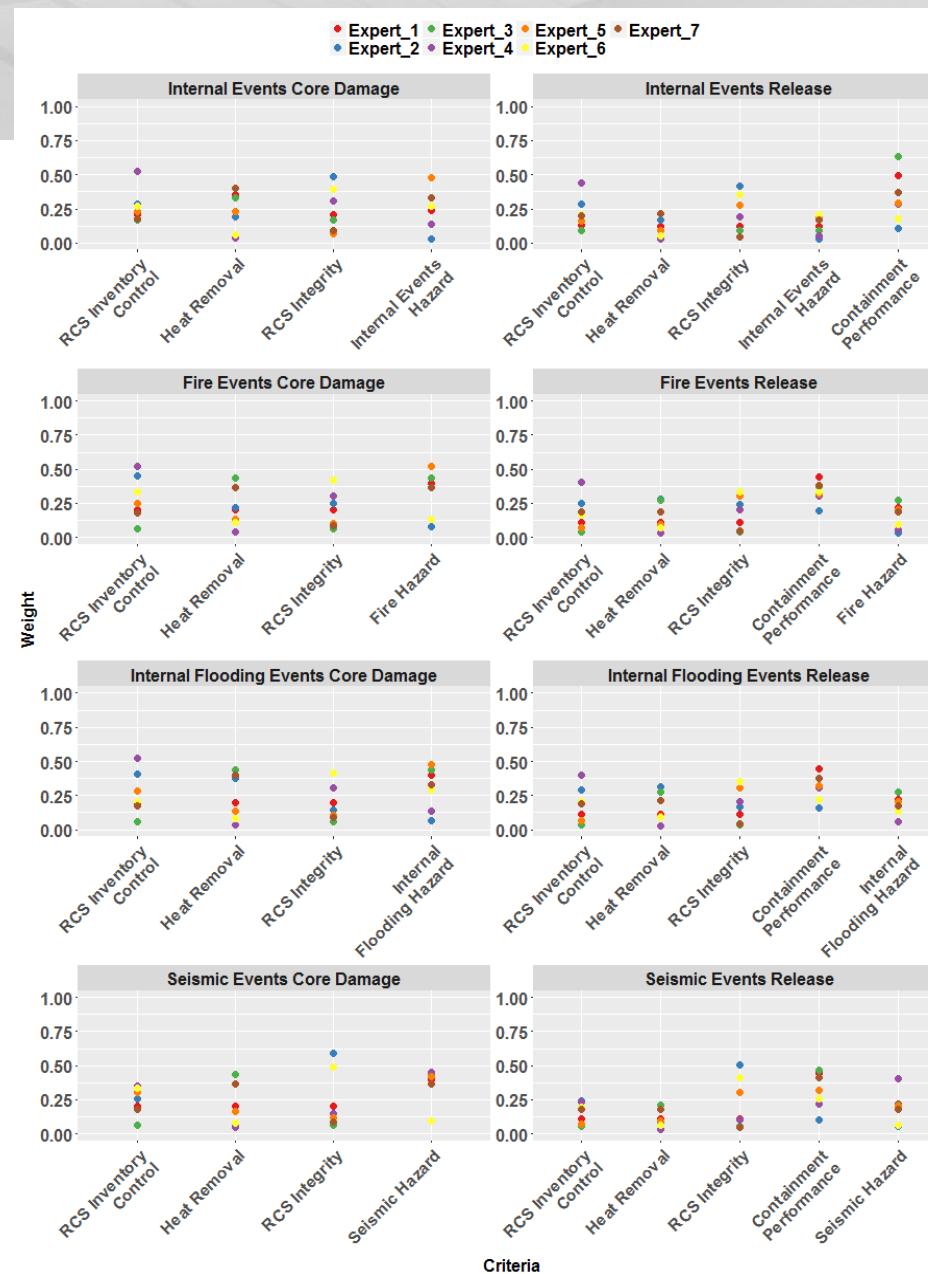
LPSD PRA PIRT Results



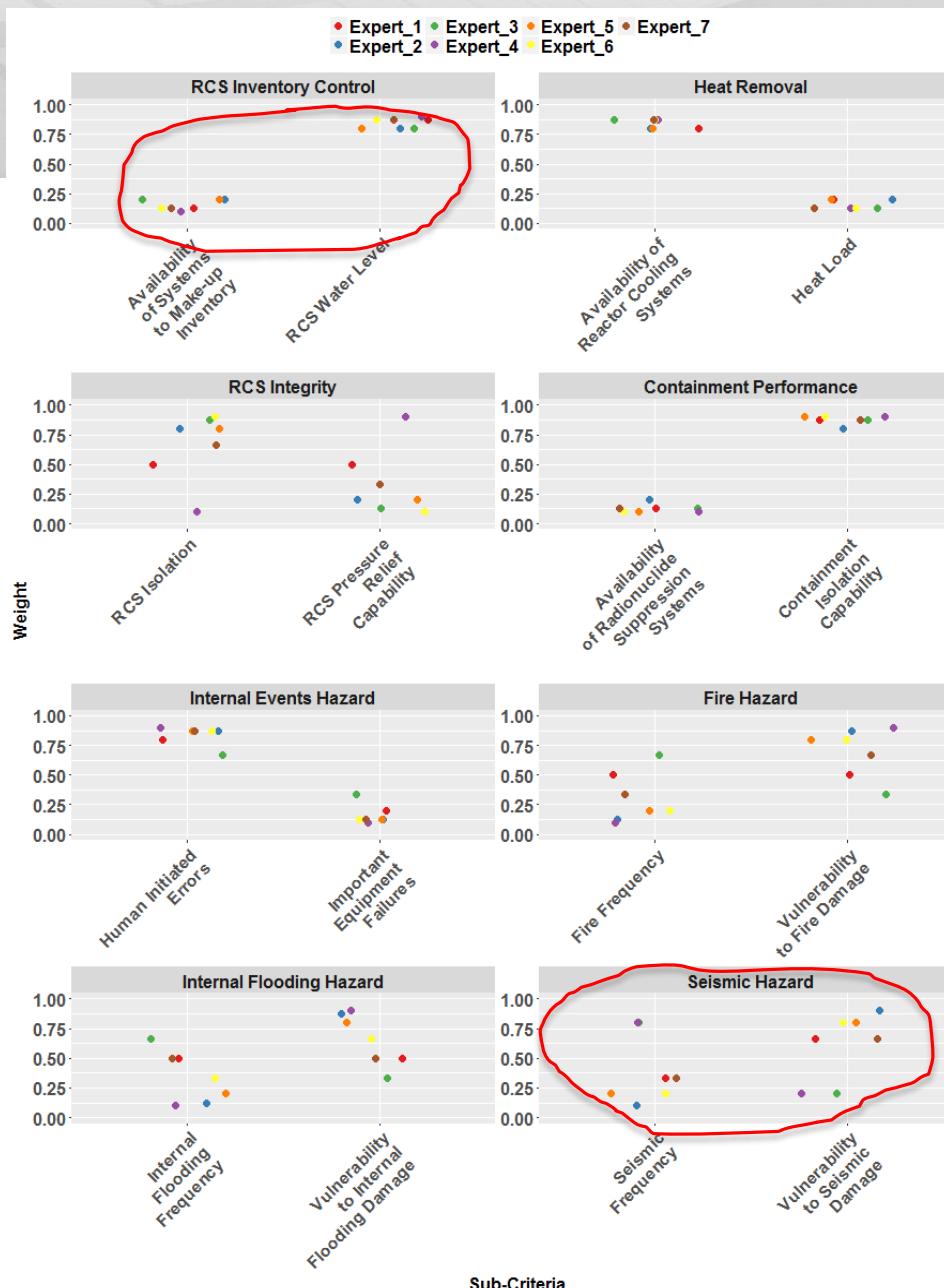
The Aggregated LPSD POS Priorities by POT

POT No. 1 – Non-drained maintenance without RHR
POT No. 2 – Non-drained maintenance with RHR
POT No. 3 – Drained maintenance outage with RHR
POT No. 4 – Refueling outage

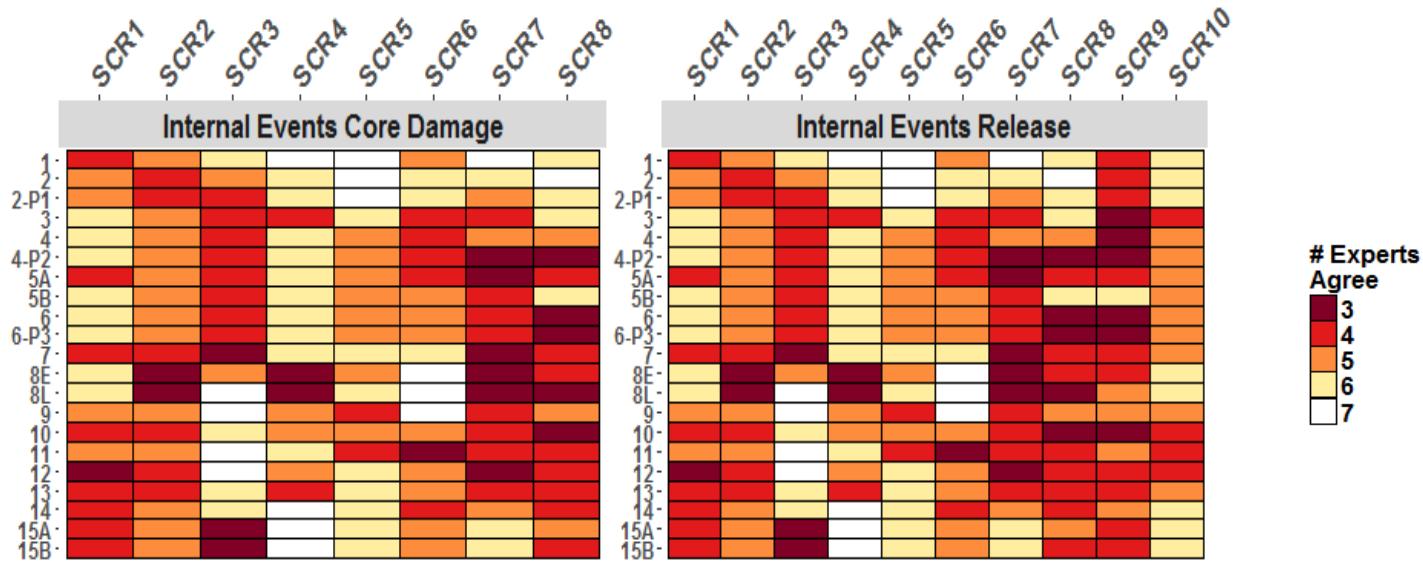
LPSD PIRT Results - Differences between experts



LPSD PIRT Results - Differences between experts



LPSD PIRT Results - Differences between experts



Level of agreement between experts about the contribution (weight) of sub-criteria

- 85% of the time a majority of experts agreed on the ranking category assignments to the POS (i.e., four or more experts agreed).
- About 65% of the time there was a high level of agreement on the ranking category assignments to the POS (i.e., five or more experts agreed).
- Areas of disagreement sometimes correlated with areas of acknowledged LPSD PRA uncertainty such as SCR7 (Human Initiated Events)
- Areas of agreement sometimes correlated with important contributors such as SCR5 (RCS Isolation)

LPSD PRA PIRT Results – Sources of Process Uncertainty

- ▶ Two important sources of uncertainty in the PIRT elicitation process were identified by the experts
 1. Nature of how POSs were defined
 - Though POS parameters can vary from the beginning to the end of the POS, they were defined as fixed parameters
 - Using typically limiting values
 2. Low Power (LP) and Shutdown (SD) POS were evaluated together
 - LP and SD operating regimes are fundamentally different in terms reactor modes of operation
 - Considering them separately could have produced further insights

LPSD PRA PIRT Brainstorming Session Results

- ▶ Brainstorming Session on LPSD PRA modeling issues
 - Primarily issues related to assumptions, state-of-art PRA practice, and lack of information
 - Identified 19 issues along with suggestions about what to do
 - Examples:
 - Initiating event frequency – A number of the experts believe that the frequency of internal events is higher at LPSD than full power, and believe the same for fire and internal flooding events
 - **Suggestion** – A survey is needed of several plants that compiles details about LPSD events and their frequency, including whether these events occur preferentially at certain POSs
 - Bypass of internal flood and fire barriers – It is not clear to the experts how risk significant these bypasses are.
 - **Suggestion** – A survey of plant practice and experience regarding these bypasses and accompanying compensatory actions
 - Thermal-hydraulic (T-H) analysis – the experts believe there is a lack of T-H analysis for the conditions that are unique from full power.
 - **Suggestion** – Development of risk informed listing of conditions requiring analysis (e.g., use of MAAP) based on a review process

► LPSD POS, POT and Hazard Priorities

- POSs that appear to be important contributors to risk of core damage and release and should be considered for inclusion in a detailed LPSD PRA are POSs No. 5A, No. 5B, No. 6, No. 9, and No. 10.
- Factors that are important contributors to POS priority and appear to be candidates for further investigation:
 - RCS integrity; human initiated events; and internal fire, internal flooding and seismic hazards
- Importance of POT No. 3 – Involves reduced water level

► Process Insights for Future PIRTs

- There is value in consulting with the expert panel members explicitly in the early stages of the PIRT process about setup of the PIRT.
- There is significant benefit in trial PIRT elicitation sessions.
- There is a trade-off to be made in design of the PIRT elicitation forms about whether to show the undelaying computations.

LPSD PRA PIRT Insights – Modeling Uncertainties

► Top Modeling Uncertainty Issues

- Lack of sufficient information about the frequency of internal events, internal fire, and internal flooding at LPSD and the vulnerability of LPSD POSSs to these events.
- Lack of information about when and what internal fire and internal flooding prevention and mitigation features are bypassed during LPSD.
- Lack of thermal-hydraulics calculations for LPSD to sufficiently characterize the conditions associated with accident sequences from shutdown.
- Lack of an enhanced HRA methodology to address the complexity and number of human actions associated with LPSD, particularly those actions taken outside the Main Control Room.

Contacts and Report Reference



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PNNL-27286 (and DRAFT NUREG/CR), “Phenomena Identification and Ranking Technique (PIRT) Exercise for Identification of Low Power Shutdown Probabilistic Risk Assessment Modeling Priorities”



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Questions

