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NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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RELIABILITY AND PROBABILISTIC RISK ASSESSMENT (PRA)

SUBCOMMITTEE

+ + + + + TUESDAY

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MAY 5, 2015

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ROCKVILLE, MARYLAND

The Subcommittee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B1, 11545 Rockville Pike, at 1:02 p.m., John W. Stetkar, Chairman, presiding.

COMMITTEE MEMBERS:

JOHN W. STETKAR, Chairman

RONALD G. BALLINGER, Member

DENNIS C. BLEY, Member

MICHAEL L. CORRADINI, Member

DANA A. POWERS, Member

MICHAEL T. RYAN, Member

STEPHEN P. SCHULTZ, Member

JOHN LAI

NRC STAFF:

STEPHEN DINSMORE, NRR

MARY DROUIN, RES

FERNANDO FERRANTE, RES

JOSEPH GIITTER, NRR

SUNIL WEERAKKODY, NRR

ALSO PRESENT:

DOUG TRUE, ERIN Engineering

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1	PROCEEDINGS
2	(1:02 p.m.)
3	CHAIRMAN STETKAR: The meeting will now
4	come to order. This is a meeting of the Reliability
5	and PRA Subcommittee. I am John Stetkar, Chairman of
6	the Subcommittee meeting. ACRS members in attendance
7	are Steve Schultz, Dana Powers, Denis Bley, Mike Ryan,
8	and Ron Ballinger.
9	MEMBER BALLINGER: Mike Corradini is
10	here.
11	CHAIR STETKAR: And Mike Corradini is
12	here. So, Mike Corradini will attend at some time or
13	another.
14	John Lai of the ACRS staff is the
15	Designated Federal Official for this meeting.
16	The subcommittee will hear the latest
17	developments on the treatment of uncertainties in
18	risk-informed decisionmaking. We will hear
19	presentations from the NRC staff and the industry.
20	There will be a phone bridge line. To
21	preclude the interruption of the meeting, the phone
22	will be placed I a listen-in mode during the
23	presentations and committee discussions.
24	We have received no written comments or
25	requests for time to make oral statements from members
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1	of the public regarding today's meeting. The entire
2	meeting will be open to public attendance.
3	The subcommittee will gather information,
4	analyze relevant issues and facts, and formulate
5	proposed positions and actions, as appropriate, for
6	deliberation by the full committee.
7	The rules for participation in today's
8	meeting have been announced as part of the notice of this
9	meeting previously published in the Federal Register.
10	A transcript of the meeting is being kept and will be
11	made available as stated in the Federal Register notice.
12	Therefore, we request that participants in this meeting
13	use the microphones located throughout the meeting room
14	when addressing the subcommittee.
15	The participants should first identify
16	themselves and speak with sufficient clarity and volume
17	so that they may be readily heard.
18	And I will remind everyone to please check
19	your little electronic devices and silence them.
20	I am assuming Sunil or someone is going to
21	give the subcommittee some basic background on this
22	process. So, I won't make any further remarks on that.
23	With that, we will proceed with the meeting
24	and I call upon Sunil Weerakkody sorry, Sunil. Yours
25	is a little worse than Stetkar to begin the

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1	proceedings. Sunil.
2	DR. WEERAKKODY: My name is Sunil
3	Weerakkody. I am the Chief of the PRA Operations and
4	Human Factors Branch of the Office of Nuclear Reactor
5	Regulation.
6	The topic we would like to present to the
7	subcommittee today is the overview of risk-informed
8	steering committee working group efforts on treatment
9	of uncertainty in decisionmaking using probabilistic
10	risk assessment.
11	What I like to do is use a couple of more
12	slides to give you the background of the subject and turn
13	it over to Dr. Fernando Ferrante and Mary Drouin to give
14	you more details of all the group activities that we have
15	done in collaboration with a similar working group that
16	the Nuclear Energy Institute led.
17	I do want to thank the subcommittee for
18	taking an interest on this issue. This is a very
19	important issue to the staff, as you will see when I
20	speak about the background of the subject. Next slide.
21	MEMBER BLEY: Sunil?
22	DR. WEERAKKODY: Yes?
23	MEMBER BLEY: I know you are reporting on
24	the working group efforts. Are you going to make any
25	comments or any of you going to make any comments

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1	relating that workshop and decisionmaking
2	uncertainty and PRA decisionmaking to the broader
3	uncertainty and decisionmaking at NRC?
4	DR. WEERAKKODY: I wasn't planning on it.
5	I think what might benefit is after Fernando goes
6	through his presentation and if you feel that there are
7	broader questions that you wanted to ask on the subject
8	
9	MEMBER BLEY: Okay.
10	DR. WEERAKKODY: Okay, we will do it that
11	way. I go to next page.
12	The first one I will give you is the
13	background of what is the Risk-Informed Steering
14	Committee is. The NRC Risk-Informed Steering
15	Committee and there is a parallel NEI Risk-Informed
16	Steering Committee are steering committees comprised of
17	counterpart senior management from NRC and NEI.
18	On the NRC side, the Office Director of NRR
19	chairs that committee. And to make sure that we have
20	broader presentation at a senior level within the
21	agency, other members of that subcommittee are we have
22	the Deputy Office Director from Research, Deputy Office
23	Director from NRO, Region I Administrator, Deputy
24	Office Director from INSR. Did I miss anybody? I
25	think that is it. So, the idea there is to form a

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committee at the senior management level who can make 1 2 informed decision on things related to risk informing. This particular committee was formed in 3 October 2013 to advance the use of risk-informed 4 decisionmaking in licensing, oversight, rulemaking and 5 So, that is a broader 6 other regulatory areas. 7 background of the committee. 8 Now, on the NEI side, we have very high 9 level participation from the Nuclear Energy Institute, 10 supported by very cognizant subject matter experts, as 11 you will see later in the afternoon from their 12 presentations. 13 I didn't want to go into a whole lot of 14 details but I did want to leave you with the objectives of the Risk-informed Steering Committee. Now, we have 15 16 a whole charter and if the subcommittee prefers it, I 17 can send you the item session number, which lays out 18 exactly what the senior executives of NRC committee 19 would be planning to do under the charter of the 20 Risk-Informed Steering Committee. 21 I have put them in bullet form here. Thev 22 will establish strategic direction of NRC staff 23 activities related to risk-informed matters. Ιt 24 doesn't say that here. Develop and communicating an 25 internal vision for future regulatory use of PRA;

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provide guidance to the NRC staff, consistent with the Commission's PRA policy statement; engage external stakeholders on the use of PRA, listen to concerns and communicate NRC actions; discuss initiatives that can be taken by the NRC to incentivize continued development of PRAs to discuss industry actions necessary to achieve the vision for future use of PRA to support regulatory decisions.

Now, this is a list of bullets. I think that the best context that I can give you with respect to this is how we implement it. There are periodic meetings between the NRC staff and the Steering Committee members where we talk about the different issues under these bullets that I have outlined of interest to the staff.

16 After those meetings, we generally have a 17 public meeting. And then we meet the counterparts of 18 the Steering Committee members, which are well attended 19 from each side of the industry, to have discussions on 20 a singular subject. In those meetings, we do discuss 21 topics about that have common interest. And 22 occasionally, and even though we discuss multiple 23 topics, occasionally, we will pick a couple of topics 24 where, based on the discussions at the public meeting, 25 the NRC steering committee might say hey, let's form a

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25	MS. DROUIN: But they are two separate.
24	working group, yes.
23	DR. FERRANTE: Yes, within the industry
22	on the working group.
21	MEMBER BLEY: Okay and outsiders are also
20	DR. WEERAKKODY: Yes.
19	seven or so members, yes.
18	DR. FERRANTE: Yes, from the NRC about
17	members.
16	four Deputy Directors has, I would say, like seven
15	as I said, is made up of the Office Director of NRI and
14	DR. WEERAKKODY: The steering committee,
13	or are we just talking about a few people?
12	committee and the working groups, are they large groups
11	MEMBER BLEY: I'm just curious. Is the
10	Decisionmaking.
9	Number 2 is Treatment of Uncertainty in Risk-Informed
8	is PRA Technical Adequacy of Methods and Working Group
7	topics to form working groups. Working Group Number 1
6	internal steering committee as well as the NEI, two
5	result of various deliberations between the NRC
4	last slide here. In one of the earlier meetings, as a
3	area. And the reason I say this is it is typed on my
2	us. There is going to be some focused work done in this
1	working group because this is a subject of interest to
	10

11 1 CHAIR STETKAR: But there is two working 2 groups. 3 MEMBER BLEY: I understand that. Well, there is like four 4 MS. DROUIN: 5 working groups; two NRC and two industry. 6 MEMBER BLEY: Okay. It is not that --7 MS. DROUIN: It is not a combined working 8 group between --9 MEMBER BLEY: That is what I thought I had 10 just heard. 11 MS. DROUIN: -- NRC and industry. They 12 are separate. 13 MEMBER BLEY: They are separate. 14 DR. WEERAKKODY: Yes. 15 CHAIR STETKAR: Yes, there is an NRC and an 16 industry on each of the uncertainty and quality of PRA 17 or whatever the other one is. 18 DR. WEERAKKODY: That is exactly correct. 19 Yes. 20 MEMBER SCHULTZ: And there are then some 21 joint meetings between the industry and the NRC and 22 those are public meetings. 23 DR. WEERAKKODY: Yes, we have public 24 telephone calls. We have a number of interactive -- and 25 Fernando will go over them. I think at this point, if

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there are no other background questions, I would really like to turn it over to Fernando Ferrante, who led the working group number 2.

MEMBER BLEY: Okay. I just want to understand the structure a little more. We had in the digital I&C, we had working groups but those working groups have both NRC and industry people. And then NRC produced interim staff guidance, like six interim staff ISGs out of that that eventually are being woven into Reg Guides in the SRP. Are these headed in that kind of direction, even though they are separate working groups?

13 DR. WEERAKKODY: Short answer is yes. Our 14 objective is we keep them independent by having two 15 different working groups. However, there are very 16 frequent, when I say very frequent, I would say used to 17 be like monthly or couple -- at least a couple of months 18 there will be a meeting or a telephone call at the 19 working group level.

20 MEMBER BLEY: And you sit in on each 21 other's meetings, it sounds like. No, not necessarily. 22 DR. WEERAKKODY: When NRC has a need to 23 engage working group number 2 counterparts, we do a 24 public meeting notice and then we will have an open 25 conversation.

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1	Now, if industry has meetings outside of
2	that, we don't participate in those. But I think in the
3	spirit of your questions, we try to work to a common
4	goal.
5	CHAIR STETKAR: Fernando's presentation
6	doesn't really address it but there have been probably
7	ten or so joint I mean some of them have been public
8	meetings, some of them public phone calls.
9	DR. FERRANTE: Right.
10	CHAIR STETKAR: But there are meeting
11	summaries of them where both of the working groups get
12	together. What they do individually, I have no idea.
13	DR. FERRANTE: Yes. To add to Sunil's
14	answer, we essentially had the two working groups meet
15	whenever we need to have a technical discussion about
16	what we are going to do and so forth. And then as the
17	work develops, we will present to the higher steering
18	committee what our findings were in a joint meeting
19	between NRC and NEI. We had, of course, internal
20	meetings to brief how things were going and things of
21	that nature.
22	So, it is not that we are desperate in any
23	respect. I mean the goal is a joint goal.
24	CHAIR STETKAR: But those public meetings
25	have been going on since something like March of last
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1	February or March at least or so of last year.
2	DR. FERRANTE: Yes.
3	CHAIR STETKAR: About a year now.
4	DR. FERRANTE: Yes.
5	MS. DROUIN: And understand these working
6	groups, our objective is to if you would get working
7	group 2, there were issues between NRC's working group
8	and the industry working group. We look at the issues.
9	They came up with recommendations and then we make
10	recommendations to the steering committee. The
11	working group is not a group that goes off and writes
12	a NUREG report, for example. We are here to evaluate
13	an issue and make a recommendation and then our senior
14	management will make decisions and assign to the line
15	management as appropriate.
16	MEMBER POWERS: So all of this effort and
17	organization and committees and whatnot, has this been
18	mandated because we have found that risk information
19	isn't very useful for regulatory or that it is
20	inadequate? What prompts people to set up all this
21	structure?
22	DR. FERRANTE: Well, I think the goal was
23	to identify issues that were maybe preventing the full
24	implementation or use of risk-informed. And so there
25	was a discussion between members of industry and NRC to

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1	set up something like a steering committee to try to
2	address them in a joint manner and in a way that
3	furthered them, not prevent them or say it is not
4	working.
5	At least our position is I think it is
6	working. And if there are issues to address, then we
7	would like to get together and discuss it.
8	MEMBER POWERS: From my perspective, we
9	see relatively few risk-based applications from the
10	full Risk Committee. In fact, one struggles to
11	remember one.
12	DR. FERRANTE: Yes, the goal is in the risk
13	base. I mean it is really a risk-informed within
14	industry who already have.
15	MEMBER BLEY: Well, usually people will
16	come in and they will have an application and they will
17	give us risk information but they will very pointedly
18	say this is not a risk-informed application. They will
19	be very explicit about that. They may give us a little
20	risk information but as soon as we ask the question in
21	risk space, well, this is not a risk-informed
22	application.
23	MS. DROUIN: That is industry's decision
24	when they submit an application.
25	MEMBER BLEY: Well what I am asking is is
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	16
1	it also your observation, and because of that
2	observation, you have set up this elaborate structure
3	and things like that.
4	DR. WEERAKKODY: That was not in fact
5	speaking from the point of view of NRR really there has
6	been a lot of work in various areas with respect to
7	risk-informed applications. I think we recently
8	briefed you on the RPI, Risk Prioritization Initiative,
9	and on the licensing side, 5069.
10	And I think, coming back to the spirit of
11	your question, this group was not formed because we had
12	a concern with respect to any problems with
13	risk-informed. I would more say that we have a lot of
14	good things going but we saw some issues that were kind
15	of in the way or challenging.
16	For example, disparate topics, treatment
17	of uncertain condition making, if I borrow one of the
18	words that Doug True would use giving the presentation,
19	he said there are things that kind of keep dragging us
20	back from going to a higher level with respect to
21	risk-informed applications.
22	So, those are the kind of things that are
23	being handled under the activities coming from the
24	steering committee.
25	MEMBER CORRADINI: So, historically, what
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1	are the successes of the committee? I am kind of with
2	Dana. I am trying to understand what is broken that you
3	are trying to move forward on. So the answer back from
4	you guys is what is broken is industry feels that this
5	could be used even more effectively than it has. So,
6	what historical successes are there? I think I know
7	only a few.
8	MS. DROUIN: I think you have to go back and
9	it is not that something is broken, broken, broken. It
10	is recognition
11	MEMBER CORRADINI: Okay, that's fine.
12	That's fine. I will change it to not broken but not used
13	as effectively as it could be.
14	MS. DROUIN: I think we can always
15	self-analyze and look at how can we be more efficient.
16	How can we be more effective? You know that is part of
17	our strategic plan. So, to try and look at where do we
18	need improvement, where can we be more effective, where
19	can we be more efficient, the risk committee was formed.
20	MEMBER CORRADINI: Okay.
21	MS. DROUIN: And then based on that, said
22	okay, now given that, let's look and see what are the
23	top priority items where we should be focusing on
24	initially.
25	MR. GIITTER: This is Joe Giitter. Maybe

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1	I can add to that just a little bit.
2	I would say the primary driver when the
3	staff got into the NFPA 805 reviews, there were a number
4	of challenges. And as we work through those
5	challenges, we realized that in the future looking
6	forward with the understanding there would be other
7	risk-informed applications, we wanted to learn the
8	lessons from NFPA 805, apply those lessons to the
9	future, an example of that would be seismic PRAs, and
10	try to set the stage for greater use of risk-informed
11	decisionmaking throughout the agency.
12	So, this wasn't just driven by industry.
13	It was a recognition both on the part of the NRC and also
14	on the part of industry that, as Sunil indicated, there
15	were challenges to full implementation of risk-informed
16	decisionmaking. And so we wanted to address those
17	head-on in a way that receives senior management
18	attention and focus.
19	MEMBER BLEY: I find that fairly
20	remarkable that you would want to learn the lessons from
21	NFPA 805 where we were bringing risk to a community, a
22	fire protection community that had historically not
23	espoused risk as a method for doing its work, so that
24	you could apply it to the seismic field, which has
25	espoused risk since the '60s in their field.

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1	I find that really remarkable.
2	DR. FERRANTE: May I add something to that,
3	Joe?
4	I think what Joe intended to say was it is
5	not that we are making seismic probabilistic from fire.
6	He is saying we had this large process with NFPA 805 and
7	license applications and now we are going to go through
8	another process. You know from a point of view of
9	process and the difficulties we had implementing that,
10	how do we learn the lessons and make sure we do it better?
11	It does not have to do with making something
12	probabilistic that was not.
13	MR. GIITTER: The issues that we're
14	dealing with largely aren't technical issues, so much
15	as they are, as Fernando indicated, process issues. Or
16	I would really characterize it as regulatory issues.
17	CHAIR STETKAR: I think that you know I
18	have read through a lot of this stuff. And I agree with
19	Joe. I'm glad you mentioned NFPA 805. I think a lot
20	of this has grown out of that experience. I think that
21	from what I have read and I have to be careful because
22	I don't want to put words in the industry's mouth, but
23	the sense that I have is the concern about the technical
24	capabilities. Working group 1 topic here has evolved
25	out of industry's concerns about what do they need to

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1	comply with to have a technically capable PRA to justify
2	a particular risk-informed application.
3	I believe they have concerns about not
4	enough specificity in that area as a result of NFPA 805.
5	For example, how does one treat a different fire
6	modeling methodology that has not been fully verified
7	and validated, according to a list in a specific set of
8	guidance? That is one example. The level of detail in
9	the PRA models is another example.
10	In the area of uncertainty, there is a lot
11	of discussion about not so much uncertainty but risk
12	aggregation. How can we aggregate the risks from fires
13	and seismic events and flooding events and internal
14	events that all have very, very different levels of
15	uncertainty and how do we think about uncertainty in
16	that sense of risk aggregation. Do we just add means?
17	How do we present those varying levels of uncertainty
18	in the context of a risk-informed application?
19	So, I think and that also had its
20	genesis, I think, in the NFPA 805 arena where there were
21	questions about uncertainties. How were uncertainties
22	and heat release rates treated? Is it a conservative
23	analysis? Is it a mean value? What are you doing?
24	And of course, these would be amplified quite
25	substantially as we go into areas like seismic analysis,

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1	where there are very large uncertainties in seismic
2	hazards, at least, and external flooding analysis where
3	a lot of people have not even addressed the issue of
4	uncertainty.
5	So, I think that is, looking forward, kind
6	of looking backward a little bit to the experience from
7	NFPA 805 and looking forward to the areas of seismic and
8	external flooding, in particular, the reason why this
9	activity was initiated when it was to try to address them
10	more comprehensively, one would hope.
11	DR. WEERAKKODY: What I would like to do is
12	I know we discussed a lot of things with respect to the
13	background, the reasons for performing, I will send to
14	John a copy of the Charter of the Risk-Informed Steering
15	Committee. And I will also send a letter that came from
16	the Nuclear Energy Institute to the then chairman that
17	I think eventually promulgated the formation of the
18	Risk-Informed Steering Committee. I think that will
19	give you a very accurate point of view.
20	CHAIR STETKAR: I've seen the charter and
21	I've seen the letter.
22	DR. WEERAKKODY: You have seen the
23	charter.
24	CHAIR STETKAR: I'm not sure whether the
25	others have.
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1	DR. WEERAKKODY: I am a little bit
2	concerned with respect, at least from the staff level,
3	creating an interpretation that wasn't intended. So
4	but do you have the letter that came to the chairman?
5	CHAIR STETKAR: I'm sure I do. I have been
6	following this but I'm not sure
7	MR. GIITTER: Okay, we will make sure you
8	get a copy of it.
9	DR. WEERAKKODY: That will give you the
10	context that was the catalyst behind forming the
11	steering committee. I think when Joe alluded to 805 in
12	the conservative sense, that is where that came from.
13	So, John will follow up with you.
14	MEMBER POWERS: Do I get the impression
15	that this was then initiated because the industry
16	thought it could save large amounts of money and fire
17	protection by going to NFPA 805 and found out it couldn't
18	or it wasn't?
19	DR. WEERAKKODY: I can't remember the
20	exact words, Dr. Powers, in that letter but it
21	definitely had a lot to do with 805.
22	CHAIR STETKAR: I haven't read the letter
23	in a long time. We should probably see the letter but
24	my recollection is that because of the industry's
25	experience with 805, they were afraid that they

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1	expressed a concern that perhaps there was no incentive
2	to use any further risk-informed applications because
3	of the onerous process that they went through on NFPA
4	805.
5	MEMBER CORRADINI: So, John, since we are
6	going to get the letter, but what I am hearing, I guess
7	I was expecting somebody to talk about flooding as the
8	next logical thing versus
9	CHAIR STETKAR: The next one up is seismic.
10	MEMBER CORRADINI: Okay. But I guess so
11	what I am hearing just by this is the motivation is that
12	what was expected to be something to be a benefit created
13	to be so burdensome by evolution that people are staying
14	away from it and it could be beneficial.
15	MEMBER BLEY: People might stay away from
16	it.
17	MEMBER CORRADINI: Might stay away from
18	it.
19	MEMBER BLEY: And the letter, as I recall,
20	you have got to wait until you see it, is just saying
21	maybe we have lost sight of what risk-informing ought
22	to mean, going back to Reg Guide 1.1.
23	MEMBER CORRADINI: Okay, I get it.
24	MR. GIITTER: This is Joe Giitter. Just
25	to add to that, NFPA 805 was the major driver but it

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1	wasn't all NFPA 805. And there were some examples of
2	instances where the staff made decisions that were based
3	on purely deterministic guidance and ignored
4	risk-informed information, where they probably should
5	have used risk-informed information. An example of
6	that was a situation where we did a NOED review and it
7	was, without getting into details, a plant with multiple
8	diesel generators and they needed or requested some
9	additional allowed outage time to repair one of the
10	diesels. And because of a branch technical position
11	that basically said you need to bring in another source
12	of AC power, it completely ignored the risk argument,
13	which would have supported the allowed outage time.
14	DR. FERRANTE: The other item is we talked
15	a lot about licensing but oversight is risk-informed.
16	We have the reactor oversight process and that was my
17	role in this. To avoid confusion, I am with the Office
18	of Nuclear Regulatory Research since last month but I
19	spent six years in NRR working on this. And my whole
20	time was in oversight. And we are making decisions.
21	We are risk-informing and the external flooding aspect
22	that was brought up is the one that really prompted me
23	to get involved with this.
24	CHAIR STETKAR: And we appreciate it. I
25	think we essentially threw out a harpoon and dragged you

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1	back in for this meeting.
2	DR. FERRANTE: That is exactly right. So,
3	if there is no other questions, I can start my
4	presentation.
5	Okay. So again, I am Fernando Ferrante.
6	I am currently with the Office of Nuclear Regulatory
7	Research and I will be presenting the work that was led
8	at the time by me within this working group. And again,
9	this is the working group on treatment of uncertainty.
10	There is a separate working group. We will not be
11	discussing that today. If there are any questions,
12	then we will refer you back to the folks involved with
13	that.
14	Before I go ahead, the NRC working group was
15	led by me but had a lot of support from the Office of
16	Research, Mary Drouin, Nathan Siu, Anders Gilbertson,
17	from NRO, Donnie Harrison and then from NRR, Ray
18	Gallucci, Doug Copeland, Steve Vaughn, and now Russell
19	Gibbs, as well as Sunil Weerakkody and others.
20	And so as Sunil alluded to, the focus was
21	really on trying to have a discussion on what are the
22	issues that we were facing within this area and try to
23	come up with some recommendations and actionable items,
24	if we can move on, and again, some actual guidance in
25	place.

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And so with that, what I will try to cover today is a little bit of the scope of this working group. It says working groups, that means the NRC, NEI Working Group within this area, you know all four group topics. Then, discuss a little bit of activities that we undertook within this area and the inside skein and then

really focus on the recommendations we came up with and

some of the path forward actions that we identified.

And so Sunil already covered the fact that we agreed to pursue specific topics. So, I am not going to go through that again. But the second bullet lists the four items that we essentially try to address as specific objectives.

We did want to step back and say what are the specific causes for not being able to address uncertainties. So, this was not a what is the state of risk-informing, generally, but what is the issue with uncertainties that is particularly being a challenge within our risk-informed processes.

Look at the current approaches that we have to deal with this and then any gaps that we will need to address as part of this activities beyond the working group.

And then, of course, proposed enhancements, the other recommendations of particular

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1	activities we should pursue beyond a working group.
2	And then, ultimately, we also wanted to
3	look at potential mechanisms for conveying the
4	importance of uncertainty within risk-informed
5	framework and we felt that that was an important item
6	enough that it needed to be brought out as a main
7	objective.
8	And so we got together. As we discussed
9	already, we had several meetings and we did get the two
10	working groups together to discuss the particular
11	objectives of identifying specific causes. We wanted
12	to look at foundational aspects, issues that were maybe
13	major issues to address and then implementation aspects
14	that were maybe challenging this.
15	Within the foundational aspects, we
16	identified there are inconsistencies within the
17	treatment of uncertainty. And that is to say we
18	discussed seismic and flooding and we acknowledged
19	that, as you mentioned, not everybody is treating
20	particular issues probabilistically and, therefore,
21	the way uncertainty is treated is also not necessarily
22	consistent across hazards.
23	Model uncertainty and completeness issues,
24	they have been with us for a while and will be with us
25	for a while. We recognize those. And then part of the

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1	issue why try to identify training and communication is
2	an important item, guidance and cultural gaps. What is
3	the perception of uncertainty? Why is this issue being
4	brought out? Is uncertainty understood in a consistent
5	way across different groups and the decisionmakers that
6	ultimately have to make the difficult choices in our
7	regulatory actions?
8	Within the implementation aspects, we
9	talked about this so-called "aggregation." As you
10	start bringing in fire
11	MEMBER BLEY: I'm still
12	DR. FERRANTE: Yes, go ahead.
13	MEMBER BLEY: I'm still trying to
14	understand what is meant by "culture gaps."
15	DR. FERRANTE: Yes. And so, as we went
16	through this process with the working groups, we
17	recognized the decisionmakers might not be fully aware
18	of what the issues are when it came to uncertainty.
19	Sometimes they are shown a value, a number, core damage
20	frequency or large early release. And it is not clear
21	that everybody understands the level of uncertainty
22	that comes to that. What are the drivers of uncertainty
23	so that the decision can be looked at more than just a
24	single number and this I the right answer or not?
25	And so I think the technical staff that

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1	leads to a decision sees it, understands it, and deals
2	with it every day and sometimes the communication is
3	difficult.
4	MEMBER POWERS: One of the barriers,
5	clearly, in understanding what the uncertainty in this
6	CDF is that nobody ever puts an uncertainty on the CDF.
7	I have never seen a CDF quoted with an
8	uncertainty.
9	MEMBER CORRADINI: I thought WASH-1400.
10	I have a student that was sending an email just now that
11	said if you go back WASH-1400 had an uncertainty bound
12	of 3.5 times 10 to the minus fourth on the high side.
13	MEMBER POWERS: Okay. Have you seen an
14	applicant come here with a CDF and an uncertainty.
15	CHAIR STETKAR: And I think that is part of
16	the problem.
17	MEMBER POWERS: Well, the applicants
18	adamantly refuse to do uncertainty analysis.
19	CHAIR STETKAR: Yes. Not all but many of
20	them downplay it and I think, quite honestly, because
21	the staff doesn't demand it either.
22	DR. FERRANTE: Well we had at least one
23	situation. Donnie Harrison, unfortunately, isn't
24	here. But I believe one case, one licensing action the
25	licensee was asked what about uncertainty and they did

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1	provide information. I am not going to give you the
2	details because I was not involved with that.
3	But I will tell you in oversight we do
4	calculate uncertainty and I have seen distributions of
5	uncertainty a number of times.
6	MEMBER BLEY: I would go a little further
7	than John did. I know of some licensees who did this
8	kind of work with uncertainties but, when they went to
9	do their submittal, they were advised by their counsel
10	that since the staff didn't say you must show
11	uncertainties that to show it would not be responsive
12	and we could get in trouble.
13	CHAIR STETKAR: Okay, that is another
14	perspective.
15	MEMBER BLEY: It is a different
16	perspective but it has happened at least a couple of
17	times.
18	MS. DROUIN: Well you have to understand
19	that Reg Guide 1.174 has set the mindset. And it is very
20	clear in that document that the uncertainties are
21	treated because you deal with the mean value. And so
22	you don't look at the distributions. You are dealing
23	with the uncertainty because you are dealing with the
24	mean value.
25	CHAIR STETKAR: Okay. That's true.

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1	MS. DROUIN: Good or bad, that is where
2	CHAIR STETKAR: That is one way of
3	interpreting those words. On the other hand, it seems
4	to be leading to a situation that says we don't care
5	about the uncertainty, as long as the mean value is, and
6	I will pick a nice bright line of 1.00000 e to the minus
7	four, as long as my mean value is 9.999999999 e to the
8	minus five and I convince you that I did a mean value,
9	I pass. And if it is 1.000001 e to the minus four, I
10	fail. And I have, therefore, included the
11	uncertainties. Now, I take the different approach to
12	uncertainty as a decisionmaker. Suppose that my mean
13	value is five-ish, e to the minus five, I am going to
14	call it 5.00000 e to the minus five if you want to.
15	But there is a ten percent probability that
16	that value, not the mean value but the core damage
17	frequency, ten percent probability that it might exceed
18	ten to the minus four. To me, as a decisionmaker, that
19	ten percent probability is useful information because
20	it tells me there is a ten percent probability, not a
21	one percent probability, not a zero percent
22	probability, and not a 70 percent probability, that it
23	might exceed that bright line goal. And in that sense,
24	the uncertainties, I think, are useful for the
25	decisionmaker, regardless of where that mean value

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1	comparison lies because they give me, as a decisionmaker
2	some confidence in the margin.
3	MS. DROUIN: Absolutely.
4	CHAIR STETKAR: So, if I said there is a 50
5	percent probability that I might exceed it and I have
6	a normal distribution and I am right below the margin,
7	I might make a different decision as a decisionmaker,
8	compared to if there is only a one percent probability
9	that I will exceed it.
10	DR. FERRANTE: Right. I mean, in addition
11	to that, what information was used to derive I mean the
12	confidence of that is even
13	CHAIR STETKAR: Mary brought up 1.174 and
14	the interpretation of how uncertainty is understood in
15	the context of that Reg Guide. And I think a lot of
16	people say well, we have already accounted for
17	uncertainty because let's say we have done the perfect
18	uncertainty analysis, we have considered everything.
19	I don't have to get into the details about parameters
20	and models and completeness. We have done everything.
21	We have done perfectly. And our mean value is 9.99999
22	e to the minus 5. Therefore, we have accounted for
23	uncertainty. And, indeed, you have for calculating
24	that one parameter of that uncertainty distribution but
25	it is not clear that that is what the intent of

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1	accounting for uncertainty in risk-informed
2	decisionmaking is because you still haven't presented
3	that information to the decisionmaker, which is a
4	different way from interpreting those same words.
5	MS. DROUIN: Right. And we have attempted
6	to address that in 1855, when you start looking at your
7	decisionmaking. But that is what I would call this
8	cultural thing of how we have interpreted the guidance
9	in 1.174.
10	MR. DINSMORE: Yes, this is Steve Dinsmore
11	from the PRA Licensing Branch, I guess, if I could just
12	make a short comment.
13	Yes, you are right that we use the mean
14	value, Reg Guide 1.174 says use it. As far as
15	requesting uncertainty bounds, we tend not to do that,
16	partly because when you just indicated that it was
17	important to you if it was a ten percent chance that it
18	exceeded ten to the minus four, it might not be important
19	to the guy sitting next to me who says well, maybe it
20	is a 30 percent chance.
21	So, we have no guidance on what to do with
22	that uncertainty. We could use it. It would be useful
23	but we actually have none. And then we start to get into
24	this, the licensees don't know what is acceptable.
25	Individual reviewers who have got to make a decision,

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1	which they honestly really shouldn't because it has got
2	a lot to do with what the licensees expect.
3	MEMBER CORRADINI: So, if I could ask a
4	different question. So, is the whole point of this
5	exercise we are looking at here to do that to provide
6	guidance as to what is acceptable?
7	MR. GIITTER: I think one of the outcomes
8	of this effort will be to come up with a consistent
9	approach for how the decisionmakers consider
10	uncertainties. Now, what you are going to hear a lot
11	about today is aggregation of risk from different
12	contributors to core damage frequency but it is broader
13	than that. And I agree that when we make decisions, we
14	should consider uncertainties, the uncertainties. We
15	should understand what they are and we should factor
16	that into the decisionmaking process. But as Steve
17	said, right now we don't have any guidance that tells
18	us how to do that.
19	DR. FERRANTE: Okay, so moving on to the
20	implementation aspects. So, I mentioned aggregation.
21	Understanding, as Joe was saying, aspects where you have
22	to deal with uncertainty, seismic, flooding. No matter
23	how much you do, you will have a significant amount of
24	uncertainty. And in those situations, I have personal
25	experience in external flooding where for some of our

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1	oversight activities, the results span several orders
2	of magnitude and, therefore, impacted the
3	decisionmaking significantly.
4	How to deal with the varying levels of
5	confidence in the mean is kind of associated with that,
6	as well as everything we have been discussing for the
7	last ten minutes. How do we communicate what is
8	important and give to the decisionmakers the full
9	picture of what they need to be deciding on?
10	And so we do go back, as part of the
11	objective, and look at the current approaches. And so
12	we do have guidance that discusses uncertainty in Reg
13	Guide 1.174. We have the NRC Inspection Manual
14	Chapters for oversight activities.
15	We have NUREG-1855, which Mary Drouin will
16	discuss a little bit more and has some of the guidance
17	already being incorporated into it.
18	We have EPRI reports that were counterparts
19	to NUREG 1855, as well as other documents like 504 that
20	tried to discuss already some of the issues that this
21	working group dealt with.
22	And we also look a little bit beyond just
23	the nuclear area but not a lot. I mean we did reach out
24	to NASA and looked at some other guidance, IEA, and so
25	forth. But the effort was really to start with our own

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1	community of risk within nuclear. And then as we move
2	on, maybe we will contact more people.
3	I should have mentioned in the beginning,
4	we did have a presentation, a session, I should say on
5	the Regulatory Information Conference, the RIC, this
6	year, and we did have somebody from NASA represented
7	that came. And we also had a participant from the
8	Department of Energy at some of our meetings.
9	MEMBER POWERS: Well, it seems to me that
10	you need to have some representation of the general
11	counsel on this, based on the anecdote that we just heard
12	about.
13	DR. FERRANTE: Well, we thought the
14	working group, at this point in time, wasn't going to
15	change any policy or any particular type of legal issue
16	that might come up.
17	It is possible down the road, if we decide
18	to change something, then we will have to go back to the
19	Office Legal Counsel.
20	MEMBER POWERS: Well, if you are having
21	resistance from the legal community on the
22	communication of uncertainty, I think you need don't
23	you need to understand the perspective that they have
24	that would cause one to suggest that uncertainty may not
25	be communicated?

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DR. FERRANTE: From the legal counsel?
I'm not sure I will engage them necessarily on that
particularly. But I think from a policy point of view
we do have issues that may come up to the purview of the
legal counsel.
If we were trying to change something, like
say for example we had been discussing the mean and how
we rely on the mean, if we were to go back to someone
that says well, maybe now we will decide the fifth
percentile is the one where we will make some decision
in terms of debt uncertainty, let's treat it
appropriately or not, I think it will be changing a
little bit more than just guidance to the staff.
MEMBER CORRADINI: I am listening here
because I came just to learn but I think Dana's question
is a fair one, which is let's say tomorrow the working
groups, however many there are of them, four of them,
and the steering committees all agree, EPRI agrees with
NRC, but then you bring it to the policy people and you
then hear that now that we have agreed on a methodology
that technically is sound, but nobody wants to
communicate it because of other issues. Wouldn't you

want to hear that a whole lot earlier in the system? That is what I think Dana is asking.

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DR. FERRANTE: Let me try to give it

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1	another shot.
2	MEMBER CORRADINI: Let me try a different
3	thing.
4	DR. FERRANTE: Yes.
5	MEMBER CORRADINI: Invent something, as a
6	surrogate, and take it to the other side of the house
7	with legal counsel and see how they would act with it.
8	Because it seems to me that unless you test drive it,
9	you could take a year of all this and then be back to
10	square one again.
11	DR. FERRANTE: Now, let me give it a shot
12	please. Let me try it.
13	Because we are dealing with uncertainty
14	today. And so it is really not an issue of going to the
15	general counsel and asking what they think about it. We
16	have issues that uncertainty is underlying the
17	decisionmaking. And that is today. I mean it has
18	nothing to do, in my mind, with the general counsel
19	telling us what to do, to be honest with you.
20	MEMBER CORRADINI: So, in other words,
21	even if you had a method now, you would know how to handle
22	that as part of the
23	DR. FERRANTE: We are making decisions now
24	with the uncertainty underlying them. For me, from a
25	technical perspective, I recognize when I am

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39 1 communicating to my management to make a decision that 2 the uncertainty is there and I try to make sure that they understand that they are dealing with that one way or 3 4 another. I think that legal counsel will have to tell 5 you shouldn't show that because maybe 6 us well, 7 uncertainty might cause somebody some heartburn. Ι 8 think it will be unfortunate because it is not the right 9 way to go with the risk. 10 MEMBER CORRADINI: So to frame it a 11 different way, your point is that say tomorrow you, by 12 the seat of your pants in good judgment, you can 13 communicate to the policymakers and legal counsel 14 assisting the policy makers that we think it is X but 15 it is plus or minus Y and Z on X, just based on my 16 judgment. 17 And your point is the technical evaluation 18 of Y and Z has got to improve but I have already gone 19 through the process of communicating this to everybody 20 else and they understand how to deal with it. 21 DR. FERRANTE: I recognize it exists. 22 Whether the general counsel has an opinion or not on 23 That is my point. And so I think we need to that. 24 address it. 25 I think not addressing CHAIR STETKAR:

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sort of the general counsel part of things, a bit of what 1 I am hearing, what gives me a bit of concern is people 2 3 talk about there isn't adequate guidance on, and I will 4 use my word, an acceptable level of uncertainty. And that bothers me a lot because if we start writing 5 quidance that says well, as long as the mean value is 6 7 less than the acceptance criteria and there is less than 8 percent probability that you exceed the seven 9 acceptance criterion, it will be deemed acceptable or 10 five percent or 30 percent or any of those percentiles. 11 That is not -- I would hope that is not the direction 12 we are going in because otherwise all we are doing is developing guidance for people who will then go out and 13 14 sharpen pencils and get into technical discussions 15 about how you sharpen your pencil. 16 Presenting the uncertainty, provided that 17 the legal counsel is not, for some reason, opposed to 18

the legal counsel is not, for some reason, opposed to the notion of explicitly displaying that uncertainty and presenting it to the decisionmaker so that they can consider it. And indeed, my risk averseness and how I treat that ten percent probability of exceeding and any other individuals in this room decisions about the importance of that ten percent is why we have decisions made by a body of people who deliberate.

And if it is the consensus opinion that that

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1	is not an adequate level of confidence, that is fine but
2	at least they know that is the level of confidence. And
3	each individual will have a different level of risk
4	averseness, determining whether that is good enough or
5	bad enough.
6	If we try to develop guidance about how much
7	actually is good enough, we are defeating the purpose
8	going in.
9	MS. DROUIN: We are nowhere going down that
10	path in 1855 of how to deal with the uncertainties in
11	your decisionmaking because, one, in the looking at the
12	uncertainty, that is not the only factor that you take
13	into account. So, you know you will balance that out
14	against other things that the licensee may be doing.
15	And so it comes down to how close you are
16	to those acceptance guidelines, where the uncertainty
17	is playing a role in there, perhaps how much
18	compensatory measures, how significant is the issue
19	that is being explored.
20	So, nowhere in there has it ever we
21	haven't even thought to come up with oh, well, 10 percent
22	is enough uncertainty or 20 percent, not even going down
23	those paths.
24	CHAIR STETKAR: And I didn't mention
25	NUREG-1855 in anything that I said. I am concerned
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1	about looking forward from the output of these working
2	groups. Steve already mentioned the fact that there is
3	concern that there isn't enough guidance on presenting
4	or acceptance, I believe, if I am putting words in his
5	mouth of the level of uncertainty. And that is where
6	I am concerned about going forward. NUREG-1855 gives
7	you a good framework for how to quantify uncertainties
8	and what to think about. It doesn't tell you what to
9	do with them later or what might be acceptable. My
10	concern is going forward
11	MS. DROUIN: Well, that is not true, not in
12	Rev. 1.
13	CHAIR STETKAR: There is Appendix G or
14	section, I can't remember what
15	DR. FERRANTE: Staff.
16	CHAIR STETKAR: The staff use of it does
17	discuss, I forget what section of it is
18	MS. DROUIN: I mean there is a whole
19	chapter
20	CHAIR STETKAR: Right, Chapter 6.
21	MS. DROUIN: that goes into now how do
22	you deal with this in the decisionmaking?
23	CHAIR STETKAR: But it is dealt with, in my
24	mind, the appropriate high-level qualitative area, not
25	in terms of 10 percent is acceptable enough. It is not

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1	fixed rules.
2	DR. FERRANTE: That's right. And we
3	recognize your point very well. I mean there is a
4	balance here between going down the path and saying this
5	is the recipe to deal with something that is clearly not
6	amenable to that, versus having something that is so
7	broad that says well, you have to think about
8	uncertainty.
9	So, we are trying to cut a middle path that
10	says well, how do we practically give some more guidance
11	to the staff to say how do you look at these things in
12	a reasonable way and in a consistent way. I think that
13	is the goal.
14	CHAIR STETKAR: I think part okay.
15	MR. DINSMORE: This is Steve Dinsmore. I
16	guess I would like to give you one quick example of what
17	we do these days.
18	Heat release rate is different if you have
19	two bundles or single bundles in a cap. If we have a
20	licensee that comes in and they are right below the
21	acceptance guidelines, and they assumed half of their
22	cabinets have single bundles, we will ask them about
23	that and see if it is important or not.
24	If they are way below the acceptance
25	guidelines or even negative because of things that they

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1	are doing, we won't pursue the issue.
2	So, to that extent, we do link uncertainty
3	but we don't really call it when you say uncertainty,
4	I think this 5 or 95 percent. But to the extent that
5	there are assumptions in there that we are uncertain
6	about, if they are near the guidelines, we will pursue
7	them. If they are far away from the guidelines, we
8	generally will not.
9	CHAIR STETKAR: And that also, and I don't
10	want to you know we need to let Fernando continue here
11	but I think that it is important to distinguish when
12	I talk about uncertainty, I do talk about those 5 and
13	95 things. I don't talk about assumptions because I
14	know when I made an assumption, or at least if I am
15	engineer, I know that I, today, made this assumption for
16	the following reason. And I ought to have some notion
17	of the degree of conservatism in that assumption or,
18	perhaps, optimism, if I want to take a risk.
19	That is different. That does lead to one
20	element of uncertainty in the whole results because if
21	I have made an assumption, supposedly if that assumption
22	is conservative, my results will be numerically
23	conservative by the amount of that assumption. But
24	that is something that I can measure. That is something
25	that I did actively. I can always relax the

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I can always try to make the models more assumptions. That does not necessarily affect the realistic. fundamental 595 stuff in the underlying uncertainty, whether it is equipment failure rates, whether it is the fundamental uncertainty in those heat release rates, or whether it is a seismic hazard uncertainty or fragility or anything else that, in general, will be a large fraction, especially as we go into things like fire analysis, certainly seismic analysis, and external flooding and things like that, will certainly be a very important part of the input to the decision process, the fact that I have got three orders of magnitude in my 90 percent confidence level. Yes, indeed, it might be fact that three

14 15 orders of magnitude might be shifted by oh, a factor of 16 two because of assumptions that I have made but that is 17 a small scale effect, compared to knowing that it is a 18 factor of a thousand in my 90 percent confidence 19 interval and that the mean is close to the 98th 20 percentile, so there is only a two percent chance that 21 I exceed the mean, if I am using the skewed distribution. 22 So, I think we have to be careful about 23 focusing on analysis assumptions, which a lot of what 24 I have read so far does, that, indeed, good engineers 25 ought to understand and know about and the fundamental

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1	underlying uncertainties that may not be being
2	addressed.
3	DR. FERRANTE: Yes, and we definitely
4	recognize that. And I will get into a few more of those
5	later down in the recommendations.
6	So, on slide six, I am discussing,
7	essentially, one of the major items that we undertook
8	under the working group, which is to have a workshop
9	between the two working groups, meaning the NRC and NEI.
10	We held that in November of last year and we essentially
11	said let's get together in a room for a one-day workshop
12	and try to work a lot of the issues out that we set out
13	to work on on this working group.
14	And so, essentially, we had Doug True from
15	the NEI Working Group lead a discussion with
16	hypothetical examples to look at particular issues that
17	arise with uncertainty and how the NRC and industry
18	guidance comport or not to dealing with those in a
19	certain manner.
20	We made summaries of those. There is a
21	detailed slides that were presented, as well as some of
22	the discussions that we had on the workshop. And so I
23	won't go into full detail on the workshop but there were
24	a number of cases that were presented. This is a list
25	of them, trying to identify different situations where

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47 uncertainty might be important to address in some manner 1 where uncertainty will present a challenge, 2 or 3 potentially, to decisionmaking. And so 1855 does have this figure in Chapter 4 5 9, which, as a risk analyst in oversight, I was not aware of and I think it is highly relevant for decisionmaking. 6 7 It establishes different regimes with respect to the 8 acceptance guidelines, whether you are removed by an 9 order of magnitude, within an order of magnitude, 10 straddling the acceptance guidelines or well above 11 them. They are looking at the level of effort and 12 justification that they needed within those. 13 I won't go into more detail than that. 14 Mary Drouin is here and we can discuss that further. 15 But one of the concepts that we talked about in the 16 workshop is we had the figure in Reg Guide 1.174 for 17 risk-informed requests, how to deal with some of the 18 decisions that have to be made. 19 And so we looked at can this figure in 20 NUREG-1855 be translated into the different regions 21 within the figure 1.174 and what type of guidance, 22 moving on to the future, may this bring out. 23 So, this is not to say we had an answer but 24 we identified that we are essentially dealing in this 25 paradigm with uncertainty and we are making decisions

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1	within regions, as Dr. Stetkar indicated very well are
2	not as clear cut lines as maybe some folks believe they
3	are. And so
4	CHAIR STETKAR: Fernando, I read I
5	looked at the slides. I read the meeting minutes of
6	that November meeting. And I have seen this picture a
7	couple of times and I still don't get it. And you don't
8	have any more explanatory slides on it.
9	So, could you take a couple of minutes and
10	explain to me what the real concern is here? Because
11	I, honestly, I have tried to understand what I have
12	read the words. I have read what seems to be some
13	fundamental concern about these concepts but I don't get
14	what the fundamental concern is.
15	DR. FERRANTE: Well, let me ask. Doug,
16	are you going to cover this in detail later? No. So,
17	that pass did not work for me.
18	CHAIR STETKAR: The harpoon has sunk in a
19	little bit.
20	DR. FERRANTE: But I will give you my brief
21	perspective, yes.
22	So, we defined regions and you were clearly
23	identifying areas where yes, and I observed this,
24	too, where a specific decisionmakers will say well, you
25	had 0.98 e minus five and, therefore, the decision

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1	clearly is below one e minus five, one e minus four, in
2	that case and, therefore, you have to decide that is
3	within that region.
4	We know that is not a reality of how risk
5	works. And so we have the figure in 1.174 and we have
6	been making decisions with those. Uncertainty is
7	discussed within the Reg Guide. But now we are going
8	down to another level of detail, which is the Reg Guide
9	1.174 does refer back to 1855 for more guidance.
10	1855 has this figure, which is essentially
11	trying to say as you reach some of those delineations
12	between the regions, which are meant to be brought, if
13	people tend to perceive them in the culture gap I
14	addressed, as maybe more defined than they should, how
15	would you go about deciding with that?
16	And so looking at this figure, you are
17	looking at one dimension where you are straddling or
18	not, depending on which region you are, an acceptance
19	guideline. But the reality is we are dealing with
20	something that has multiple regions and you might be
21	impacting in different areas.
22	So, is it that in your baseline CDF you are
23	straddling the region where maybe more additional
24	changes in CDF should not be accepted or is it that you
25	are within a region that says between Region 2 and 3,

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1	say, where you might need to look at things a little bit
2	more carefully.
3	So, we were trying to really look at what
4	does 1855 talk about in terms of those regions or regimes
5	and how would that transport back into 1.174 with
6	thinking. I mean we didn't resolve the issues. We
7	didn't necessarily arrive within the working group how
8	will that work but we acknowledged that that is where
9	we are and maybe we need to move on.
10	MEMBER BLEY: Fernando, if I may.
11	DR. FERRANTE: Sure.
12	MEMBER BLEY: As I recall, 1.174, and as
13	you say these aren't hard lines but they talk about an
14	integrated decision process, which we clearly call
15	upon, especially when things aren't as clear as you
16	might have hoped they would be.
17	DR. FERRANTE: Right.
18	MEMBER BLEY: So, I still don't see. I
19	mean if I understand your response to John, what you are
20	saying is this is trying to say whenever you are at one
21	of these dividing points, you have to look at it
22	carefully, think about all the factors that affect it
23	and that is bringing in this integrative decision
24	process.
25	DR. FERRANTE: Right. And so I think we

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are trying to say how do we go down to another level of detail and what do you really do with it. I mean the integrated decision process discusses it and uncertainty is discussed in Reg Guide 1.174. Can we go down to another level of detail without falling into the trap of trying to be too prescriptive in those regimes?

CHAIR STETKAR: My recollection, and I have to go back and look at our letters and my notes and I didn't do that, on 1855, the horizontal and vertical strips out here from 1855 is on the strip. If you had the bigger blowup, Fernando, pop that one up here.

I think, at least in the subcommittee meeting, I don't think we addressed it, but I'm not sure, in a letter, the notion here is that the closer you get to the guideline, the more attention you need to pay to uncertainty. I mean that is basically in the context of 1855, what this is trying to say.

18 I think we said that you ought to pay 19 attention to uncertainty, regardless of where you are, 20 and just let it fall where it may. So that this 21 increasing attention to uncertainty might be more 22 important for the decisionmaker but, indeed, from the 23 perspective of your basic practitioning analyst, if you 24 quantify all of the uncertainties, if you are far enough 25 from the decision criterion, either on a horizontal or

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1	vertical access of 1.174, fine, you have done your job.
2	It doesn't mean
3	This would tend to say that if you are far
4	enough away from the decision criterion, you don't need
5	to address uncertainties. And in that sense, that is
6	where I understand there might be some confusion by the
7	industry. You just say quantify the uncertainties to
8	the best of your ability and present them to the
9	decisionmaker. I don't understand the confusion,
10	regardless of where you are.
11	MS. DROUIN: If you are in Regime 1 versus
12	Regime 3, it doesn't mean that we are not concerned about
13	the uncertainties. It is more because this is guidance
14	in terms of making your decision. So, you know, the
15	analysts need to have some confidence in what the
16	licensee has proposed. And so how much he will start
17	pulling the string and trying to get that confidence is
18	going to depend, whether he is challenging those
19	acceptance guidelines or not.
20	So, it is more looking at the soundness of
21	the analysis.
22	CHAIR STETKAR: But there my concern about
23	the prescriptiveness of this process comes back to the
24	statement that I had earlier. That I, personally,
25	might feel much different about a ten percent
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probability of exceeding a guideline than anybody else in this room. And trying to tell me that I ought to feel differently is something that you can't do. You can't tell me that I, personally, will feel more or less comfortable about exceeding a guideline by 10 percent, compared to, let's say Dennis, who might feel just as comfortable as I if the guideline was exceeded by 45 percent.

9 But if you present that ten percent to both 10 of us, he would feel exceedingly comfortable and I 11 would, perhaps feel less uncomfortable. Now, in a 12 risk-informed decision process, where we do it by 13 deliberation, not just me, and I look at everything 14 else, we reach a conclusion is the ten percent enough 15 Well, that is worthy of pulling those extra strings. 16 based on the totality of the information. It isn't just 17 based on whether or not I have done the uncertainty 18 analysis. And I might disagree but if nine out of the 19 ten of us all agree that it is not worth pursuing, fine. 20 MS. DROUIN: And the use of this figure 21 does not just take into account the uncertainty. There 22 is lots of other things you take into account. 23 But I can't believe if somebody came in with 24 say their core damage frequency is one e minus seven,

now you might start thinking wow, that is pretty low and

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1	you are three orders of magnitude away from your
2	acceptance guidelines, there are other things you are
3	going to think about in having confidence in that number
4	in making your decision.
5	CHAIR STETKAR: But is that a rationale of
6	why I don't present the uncertainty in that ten to the
7	minus seven number?
8	MS. DROUIN: I think that is where you have
9	to decide. You know if we have a policy decision, and
10	this is where OGC, if you are changing that policy
11	decision from we are using the mean values and that is
12	how we are accounting for our uncertainty, you may not
13	like it, John, but that is the policy.
14	CHAIR STETKAR: I'm sorry, the policy says
15	the Reg Guide says you compare the mean values
16	MS. DROUIN: You compare the mean values.
17	CHAIR STETKAR: because they are the
18	only values that, indeed, provide the best estimates.
19	And you can sum across any distributions and they will
20	provide the best estimate. That is why they are the
21	best single-value indicator and I get that. I
22	understand that completely. I'm not arguing with that.
23	What I am arguing with is the notion that for some
24	reason, we don't we are trying to prescribe when you
25	should quantify uncertainty and when you should provide

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1	it to the decisionmaker and how the decisionmaker should
2	account for that uncertainty.
3	I mean I just don't understand why all of
4	that prescription is necessary.
5	DR. WEERAKKODY: I'm not supposed to ask
6	any questions.
7	MS. DROUIN: I think this is a discussion
8	for another day.
9	CHAIR STETKAR: Well, that is why we are
10	having this subcommittee meeting.
11	MS. DROUIN: Well, the subcommittee I
12	mean I did not give you a detailed presentation on 1855,
13	which would explore some of this because I came to this
14	meeting that this was to be a meeting on Working Group
15	2 and not to get into all this technical detail that you
16	are looking for. That is a different meeting.
17	MR. GIITTER: I think I can summarize.
18	Certainly, if there was really a desire or need to have
19	the uncertainty information with every point estimate,
20	that is something we could do. But the fundamental
21	question is, is that going to help you make a better
22	decision.
23	And I think what you are hearing from the
24	staff is that if the decision hinges on, if it is a
25	question of you are right below a threshold of some kind,

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1	then that uncertainty information could be very
2	valuable in making that decision.
3	I think in Mary's example, where you have
4	a three order of magnitude difference between where you
5	are with your point estimate in the threshold, that
6	uncertainty information isn't as important to you in
7	terms of making that decision.
8	CHAIR STETKAR: Joe, I will agree with you
9	there. But I don't want to focus on numerical minutia
10	because as soon as you start to present drawings like
11	this, you will naturally get push back from
12	practitioners, whether it is the industry or whether it
13	is NRC reviewers saying well, if three orders of
14	magnitude is okay to ignore it, is two orders of
15	magnitude good enough. Well, maybe, probably. Is a
16	factor of 50 good enough? And you get into those
17	prescriptive criteria, which is what I hear people
18	starting to ask about when we start comparing those big
19	figures.
20	At what point must I start to honestly
21	consider quantifying and presenting uncertainty? If
22	it is below some threshold, what is that threshold? And
23	how do you justify that threshold?
24	And my point is that if I am presented the
25	uncertainty, you can't dictate to me what my risk
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averseness is. You can present the information to me and make sure that every decisionmaker is presented the same information. And I'm sure that we have technical confidence in that information but you can't tell me that ten percent, that I ought to accept ten percent and he ought to accept 30 percent.

MR. GIITTER: Right. No, I understand that. And Fernando will verify we have a branch that Sunil leads that does Phase 3 independent reviews of Phase 3 evaluations for the significance determination process. And when they come in and present the results, whether it is a green, yellow, red, or white, whatever it might be, they typically come in and they talk about the uncertainties and they talk about how those colors would change, depending on how the assumptions would And that is the kind of information I need to change. know as a decisionmaker. I need to understand that.

And I think it comes down to the decisions that are made. How you incorporate that uncertainty information I think is largely a matter of good engineering judgment.

22 CHAIR STETKAR: How you incorporate it 23 when you make the decision or how you incorporate it when 24 you present the information to the decisionmaker? 25

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MR. GIITTER: Both.

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1	CHAIR STETKAR: The second part of that is
2	what I have concerns about.
3	DR. WEERAKKODY: I have a clarifying
4	question. When we had this discussion we just pick when
5	or at one point or should we ever mandate or not mandate
6	uncertainties, are the questions in the context of
7	quality discussions or more like qualitative?
8	The reason I ask that question is when we
9	go to the reactor site, it is almost always when the
10	decisionmakers have presented the staff needs or
11	additions, you know we talk about uncertainties but not
12	necessarily always in terms of quantitative but
13	sometimes quantitative, sometimes qualitative.
14	MEMBER BLEY: Well, if I may, to me, it is
15	both. I mean quantitative is obvious. But the
16	qualitative side, just as a reviewer, if somebody
17	presents you means, how do you check and see if that is
18	a reasonable thing without seeing how the means were
19	derived? If it is a whole PRA and you stick point values
20	in it, what you get out isn't a mean anymore. It is
21	something else.
22	DR. FERRANTE: Right. And we recognize we
23	are dealing with that, in fact. I know exactly what you
24	are saying. And so I think I am trying to balance the
25	two positions here.

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1	One is, the decisionmakers will ask how do
2	I if you present that information to me, how do I deal
3	with it? And we are trying to balance their
4	understanding of what we are presenting and how should
5	they decide without telling them this is the answer. I
6	mean all we can do in uncertainty is say if there is,
7	for example, as Joe was saying, an SDP issued and they
8	have external flooding, what is the confidence, some
9	information that comes with it? What are the numbers?
10	I mean we don't even know our numbers but we need to
11	understand what is the state of the art in trying to
12	derive some of those numbers. Because ultimately, we
13	will be making a fairly serious decision with respect
14	to a finding where maybe we have identified a cliff edge
15	effect, which is another qualitative aspect that we are
16	dealing with here, extent of conditions, safety
17	margins, defense-in-depth, none of those are being
18	ignored in this process.
19	So, the question that keeps coming back to
20	us is how do we present that to the decisionmakers
21	without going into policy questions or issues like that.
22	Mary Drouin said she will answer all of your
23	questions in her presentation. So, I should move on.
24	(Laughter)
25	CHAIR STETKAR: And in the interest of

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1	time, since Doug probably wants to get out of here before
2	he starves to death, we should move on.
3	DR. FERRANTE: Okay. So, I will get into
4	so, I am going to go into the meat of the presentation,
5	which are the recommendations.
6	We essentially had a discussion on how to
7	do this to make sure we were doing it appropriately and
8	independently. The NEI Working Group agreed to write
9	a white paper to us, which is available via the ML number
10	on slide 10 and we, the NRC Working Group reviewed the
11	white paper and provided our own memorandum internally
12	to the NRC steering committee members. So, we can make
13	an assessment of the recommendations as well as what the
14	follow-up actions are.
15	The overarching team that we permitted on
16	the memo from the NRC Working Group was that we agree
17	with the overall recommendations, which is not a
18	surprise because a lot of the recommendations came out
19	from discussions with them, the working group
20	activities and the meetings and so forth. So, these
21	were not things that were presented to us out of the
22	dark. We already knew some of the recommendations and
23	we also provided our own characterization and our own,
24	essentially, opinion, about some of the actions and how
25	we will communicate that to our management.

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61 And so we submitted the memorandum and 1 2 eight recommendations are listed on slide 11 and I will 3 get into each of them next. The first recommendation has to deal with 4 5 clarifications on the expectations on the treatment of uncertainty. And so it deals with everything we have 6 7 been discussing up to this point, recognizing that we 8 have made significant revisions to NUREG-1855, which 9 Mary Drouin will cover after me. We believe, and I 10 firmly believe this, that 1855 provides a very good vehicle for discussion of uncertainties. 11 It discusses 12 the issues of uncertainty consistently. It presents 13 them in a clear way, in ways that myself, as an oversight 14 risk analyst maybe wasn't aware before and I believe the NUREG-1855 number 1 needs to be elevated in terms of the 15 16 importance that it has in communicating some of these 17 issues, as well as looking at to how do we move on and 18 either add gaps by performing a pilot, as was done with 19 the previous issuance of NUREG-1855, as well as 20 concerning how beyond this pilot we can move on and do 21 enhancements based on this. 22 And so I believe one of the big lessons 23 learned for me, personally, at least, is we are doing 24 work in this area. Good work has been done and spent. 25 We are not starting anew on this area and we are not

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Recommendation number two is on the risk aggregation that we already discussed. The team, overall, is looking at multiple hazards coming into the picture. And an issues which is also not new, which is other reports, historical reports I have looked at, different hazards and aggregating them or at least presenting them combined, what does that mean now when you put those into regulatory actions that deal with PRA or uncertainty might play a role in that?

We recommend doing additional work on this. We don't recommend necessarily changing our guidance radically but EPRI has done work, which maybe Doug True will talk about a little bit on the aggregation aspect. And the, I think, ongoing work, it will be positive in this area.

20 We will have to figure out what exactly what 21 we will do with that, how we will review it and 22 potentially eventually incorporate it. But our 23 recommendation is this is a good area for discussion 24 because it will keep continuing to surface, as we have 25 seismic PRAs and as we go into external flooding risk

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1	type of activities.
2	Recommendation three has to deal with a
3	more, an aspect that deals more with consistency. You
4	know how do we make sure that everything is truly
5	integrated, as we have the Inspection Manual Chapters
6	the NRC has, as we have LIC 504, as we have NUREG-1855
7	and put at least a veneer of consistent treatments so
8	we don't have different folks having different
9	perceptions or what the different documents are saying
10	on making different decisions on things that truly
11	matter.
12	Recommendation four has to deal with kind
13	of the overall miscellaneous but it really speaks to the
14	fact that we have several other activities ongoing that
15	will touch upon uncertainty in some manner or another.
16	So for example, I believe the ACRS
17	subcommittee was briefed at some point on Probabilistic
18	Flood Hazard Assessment Research Plan. There was a
19	user need that came out. I was involved with both the
20	plan and the user need. And it deals with everything
21	we have been dealing with in oversight when we have
22	external flooding, which is an area, as Dr. Powers
23	indicated, you know like fire was not really truly
24	probabilistic or even close to being fully
25	risk-informed, although some agencies outside the NRC

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1	have gone much farther than we have in this area.
2	And so we are doing some work there and the
3	whole recommendation here is let's pursue this work and
4	as it touches upon uncertainty aspects, hopefully this
5	will come back and inform a little bit more on some of
6	the decisions and how NUREG-1855 helps or not within
7	those.
8	Recommendation five talks about mitigating
9	strategies. And we recognized up front that this was
10	a much bigger item than just uncertainty treatment.
11	There is a whole aspect of how will this be incorporated
12	within the PRA standard, how will it be considered in
13	different applications. We recognize this is
14	important and we recognize it touched upon uncertainty.
15	And we recommend continuing the work and assure that
16	mitigating strategies deserves its proper framework and
17	also that uncertainty is considered within the
18	framework.
19	CHAIR STETKAR: Fernando?
20	DR. FERRANTE: Yes.
21	CHAIR STETKAR: You know I fully agree with
22	the staff's characterization of that recommendation.
23	As I read through it and as I read through some of the
24	background documentation, I kept being struck by the
25	notion of why in the heck wouldn't you account for

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1	ignore it, it has a life of its own.
2	Why the heck wouldn't you account for these
3	mitigating strategies in the context of a PRA that gives
4	you the structured process to examine the effectiveness
5	of the strategy, each strategy within the context of all
6	of the scenarios that could require them? I mean I
7	recognize that there are sources of uncertainty that
8	need to be addressed but the notion that it might not
9	be appropriate to consider these mitigating strategies
10	in the context of PRA framework baffles me.
11	DR. FERRANTE: Right. I will give you a
12	very brief summary of what I think is the issue. I mean
13	I think the issue is really not do we account for it or
14	not. I think if it is credited, it should be accounted
15	and it would be fair to account it. The question I think
16	here we are dealing with is really how much credit do
17	we assign to this and how do we do it consistently. How
18	do we review some of these mitigating strategies in a
19	way that is appropriate, if you are putting them within
20	the PRA?
21	I clearly didn't hit the spot, based on your
22	response.
23	CHAIR STETKAR: No, you didn't but that's
24	okay. This will work itself out as the working groups
25	go forward.
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1	DR. FERRANTE: Okay.
2	DR. WEERAKKODY: But we do agree with the
3	spirit of the question in that there is a recognition
4	that because of the additional measures and procedures,
5	there is a potential for risk reduction, at least in the
6	plants. The core-damage frequencies won't go around
7	and we have some elemental numbers.
8	CHAIR STETKAR: One would hope so but my
9	whole point is that without examining those strategies
10	in the framework, in the context of that risk model,
11	which indeed lays out the scenarios and says here is a
12	scenario where that mitigating strategy could be used
13	but some facet of it doesn't apply to this scenario.
14	Now, if that scenario by itself is an
15	insignificant contributor to risk, so be it. If it is
16	a potentially significant contributor to risk but there
17	is some element of that strategy that didn't account for
18	those conditions in its assumed boundary conditions or
19	however you want to characterize it, that is also
20	important information, one would think.
21	And we are not talking about taking credit
22	for anything. We are talking about objectively
23	examining the effectiveness of these strategies within
24	the context of a risk model.
25	DR. WEERAKKODY: We have begun doing that.

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1	That is not to understanding some of the challenges we
2	have to come in terms of but clearly there is more
3	evaluation on at least speaking for the staff to explore
4	what kind of credit that can be given.
5	CHAIR STETKAR: Just be careful because I
6	am not that there aren't challenges. I'm not saying
7	there might be large uncertainties. On the other hand,
8	there is challenges of modeling at-risk scenarios in an
9	internal events PRA and we somehow get around doing
10	that.
11	There is large uncertainties thermal
12	hydraulic response during an ATWS event. We somehow
13	get around doing that. So, just because it is difficult
14	doesn't mean that we can't do it in the context of risk
15	assessment.
16	DR. FERRANTE: Yes, and we fully agree with
17	that.
18	CHAIR STETKAR: And just because this is
19	something new doesn't mean that we should ignore it
20	because it is difficult.
21	MR. GIITTER: Excuse me, this is Joe
22	Giitter. You are going to hear from industry. There
23	is two issues that industry is proposing to focus on
24	moving forward for the Risk-informed Steering
25	Committee. One of them is aggregation and the other one

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1	is how do you address FLEX and mitigation strategies and
2	PRAs.
3	So, that is something we are focused on.
4	CHAIR STETKAR: That is one of the reasons
5	I brought it up in this context. Thanks, Joe.
6	DR. FERRANTE: So, on slide 17,
7	recommendations six and seven, where six refers to
8	essentially trying to address some of the aspects, the
9	cultural aspects, and consistency and integration that
10	run across these recommendations. So, one of the
11	recommendations the NEI Working Group provided was to
12	try to have an annual Industry-NRC meeting on
13	risk-informed decisionmaking to bring all of the issues
14	that have been discussed here today to a forum and then
15	try to move on or at least identify what are the
16	problems.
17	We agree with that and we will work to set
18	that up within
19	MEMBER POWERS: Would I be wrong in
20	interpreting this as saying gee, we would like to get
21	together and we want to keep doing it?
22	DR. FERRANTE: I think part of it is that
23	but the other part is also the working group goal was
24	to try to come up with some of the recommendations.
25	This meeting will probably be more what is the guidance

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1	available, what is the understanding on risk-informed
2	decisionmaking, rather than debating the same issues as
3	the working group.
4	I actually, from a personal, selfish point
5	of view, would like for the working group to be sunset
6	immediately but that is just my own opinion.
7	MEMBER POWERS: I am beginning to
8	understand that.
9	One of the things that you mentioned both
10	at the beginning and now toward the end of your
11	presentation, which is a well-designed presentation, is
12	we need to understand what the thinking is, speaking of
13	other people's thinking not your own, on how do you
14	determine that.
15	DR. FERRANTE: Well, I think I will speak
16	from my direct experience on the oversight issues.
17	It was clear to me, when we were making
18	regulatory decisions within oversight, that there was
19	a misunderstanding of uncertainty and how uncertainty
20	applies to decisionmaking, particularly with respect to
21	external flooding.
22	And so a lot of discussion centered around
23	why isn't the NRC just willing to believe that we have
24	the right number and, therefore, accept the decision
25	that is being put forward by the industry in that

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particular instance. We vowed understanding that we 1 understood there was a lot of challenges, as 2 we 3 identified to irreducible uncertainties, cliff edge 4 effects, integrated decisionmaking that will make it 5 difficult to believe, number one, that the answer is accurate; number two, that the right decision will be 6 7 just to ignore the problem because there is too much 8 uncertainty or because one particular method points to 9 one answer, one different method may point to different 10 answers. So, I believe strongly that having that discussion when we are in the heat of the battle is the 11 12 worst thing we can do for a decision. What we need to 13 recognize is the problem exists. There is а 14 misunderstanding and it can go both ways. You know, the 15 NRC might have its own. 16 MEMBER POWERS: What I get the impression 17 is that you do not have a group that, over the course 18 of the year, will look at whatever subset of decisions 19 that it chooses to look at and say yes, they have really 20 used uncertainty very well here, made the appropriate 21 kinds of uses of it, or they have not, that you do not 22 have that going on.

DR. FERRANTE: We do have a process to go back and look at reactor oversight decisions and how that is being consistent. In fact, Sunil's branch,

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which I used to be a part of, had that mission as its goal. And so I wouldn't say that we don't look back on the decisions we made on how we do uncertainty. I think we recognize for this working group that we can do better and we could do further activities on uncertainty. So, that is really my position on that particular aspect.

7 And moving The so, on. next 8 recommendation seven was essentially going back to the 9 idea of education of petitioners and having the common 10 understanding, as you mentioning, on how the decisions 11 were made, where the guidance comes from. We are 12 looking to potentially, in fact there was already an 13 effort ongoing when this working group was formed, to 14 go back to some of our internal NRC training in terms 15 of risk-informed and PRA for a number of petitioners and 16 revamp that. And so our recommendation in that area is 17 to look at how we are doing that work and whether we need 18 to do something else as NUREG-1855 is used in trials and 19 pilots and then feedback whatever modifications may be 20 done that particular training.

21 The industry will equivalently look at 22 whether we need to do maybe a joint type of activity 23 within this or they will have their own education and training tools within industry.

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recommendation eight, essentially, So,

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touches on that again. And so I kind of already alluded to that. This is a little bit repetitive with respect to the last one but review the internal training, as I mentioned. And this is the one that really deals with the direct interface with non-practitioners and decisionmakers in general.

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7 From my experience, I have been taking a lot 8 of the training and having gone through that process in my beginning career at the NRC, I mean a lot of the 9 10 training I observed touches on issues like Monte Carlo 11 and Latin Hybercube and that technical staff will 12 understand or at least be aware of. But it doesn't 13 quite go back and say okay, if you are dealing with this, 14 how do you then communicate it upwards and have a proper 15 way of indicating what is important to decisionmaker. 16 And the opposite is also, the converse is also true in 17 the sense of once decisionmakers sit in a room, they are 18 being exposed to PRA information. They are being told 19 about event trees and fault trees. But sometimes the 20 training will have more an impact in terms of given that 21 these folks are not necessarily going to be running the 22 software, what is it that they need to understand about 23 uncertainty, when they make a decision and how do they 24 look at it from a general practice.

I'm not saying that the guidance doesn't

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1	exist or that it is not looked but I think sometimes we
2	can make a better job of communicating what is
3	important.
4	CHAIR STETKAR: Fernando, when I read
5	through the recommendations, something that this one
6	in particular, something that struck me is it seems to
7	be focused at the level of the practitioner and some of
8	what you just said seems to be focused at that level.
9	In other words, I, as a practitioner, how
10	do I characterize the uncertainty and present it to the
11	decisionmaker, such that the decisionmaker can make the
12	decision? I didn't see anything that was targeted at
13	the decisionmakers and should this training not be
14	focused at the practitioner. Should it be focused at
15	all of the managers, including commissioners?
16	DR. FERRANTE: Yes, that was my intent.
17	Yes.
18	CHAIR STETKAR: Okay, it didn't come
19	through when I read this recommendation because, in my
20	experience, if I am the boss and the boss says I need
21	you to present me the uncertainty and convince me that
22	you have accounted for that uncertainty because that is
23	what I need and this is why I need it, then the
24	practitioners will do that.
25	If the decisionmakers don't have that

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to--down focus and don't really have an appreciation for it, then regardless of what I tell the practitioners, they might follow it or they might not follow it. But on the other hand, if I present it to my boss and the boss says well, why are you giving me this stuff, so we have defeated the whole purpose.

7 DR. WEERAKKODY: We have, not because of 8 necessarily -- you know, this is partly contributed but 9 there have been other recommendations that have been 10 made geared more towards the reactor oversight process, 11 where we are on a path to create training for the 12 decisionmakers who use PRA. And this would be one 13 component of that training.

So, your point well-taken and there are other initiatives on the way that we already created that type of training.

CHAIR STETKAR: All I am saying is you may want to think about training at a pretty high level for the decisionmaker and why uncertainty is important and why they might be concerned about it.

DR. WEERAKKODY: Because there have been other studies, efforts, we call it the significant determination process. There was a study done in that group primarily consisting of practitioners, like SRAs, recommended the decisionmakers receive training on PRA.

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1	And we are implementing that.
2	CHAIR STETKAR: You mentioned ROP and SDP
3	a couple of times. I am talking about conditioners.
4	Okay?
5	DR. WEERAKKODY: Okay.
6	CHAIR STETKAR: I am talking about
7	conditioners. I am talking about branch chiefs. I am
8	talking about
9	DR. WEERAKKODY: Division directors.
10	CHAIR STETKAR: division directors. I
11	am talking about people at fairly high levels.
12	DR. FERRANTE: I think that we will have a
13	hard time already trying to train our direct management.
14	If you want us to train the commissioners
15	MEMBER BLEY: Let me pause you here because
16	kind of to me the way John has put it, is saying they
17	don't understand the concept. And that is just not
18	true.
19	Decisionmakers always address uncertainty
20	in some fashion. They have their ad hoc ways to do it.
21	They deliberate about it. They talk about what might
22	my analysts have thought about. What they need to
23	understand is what you have put together can be helpful
24	to that process, which is different. You don't want to
25	train them to be PRA analysts. You want them to

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1	understand why what you are doing with respect to
2	uncertainty can help them in ways that they have
3	addressed informally or through discussions previously
4	to get a better handle on it.
5	CHAIR STETKAR: And that is a different
6	kind of thing. And it is a different kind of training.
7	I mean Dennis has elaborated more than I did.
8	It is a different kind of training. It is
9	not on how one quantifies uncertainty or how one thinks
10	about that uncertainty distribution.
11	DR. FERRANTE: That point is well taken.
12	CHAIR STETKAR: It is an appreciation of
13	how explicit presentation of that uncertainty, whether
14	it is quantitative or qualitative explicit
15	presentation, is a good thing.
16	DR. FERRANTE: Right. That is why we use
17	the word education as opposed to training because you
18	can ask people to sit in a room for a couple of days and
19	maybe not learn a lot from that. But to have something
20	that is of equal to tell them exactly what you said, this
21	is why this is important, without trying to make them
22	PRA practitioners was really what we had in mind with
23	part of this.
24	CHAIR STETKAR: Okay, I am glad to hear
25	that.
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1	DR. FERRANTE: Yes.
2	CHAIR STETKAR: I interpreted it more as
3	training at practitioner and analyst level.
4	DR. FERRANTE: No, that was not the whole
5	intent. Definitely not.
6	MEMBER BLEY: And certainly it includes
7	helping their staffs understand, so that the staffs can
8	pass it on.
9	DR. FERRANTE: Yes, absolutely.
10	MEMBER SCHULTZ: I think it is important to
11	clarify the communication associated with these
12	training programs and education programs. Because
13	unless you are very clear on what their intent is, you
14	will never be able to implement the range of audience
15	that you want to reach.
16	DR. FERRANTE: Absolutely, yes.
17	MEMBER SCHULTZ: It is very important to
18	define that, otherwise you will find that people are not
19	expecting to be trained. People didn't know you were
20	intending to do it.
21	DR. FERRANTE: Right.
22	MEMBER SCHULTZ: And so from the outset, it
23	is important to define it carefully.
24	DR. FERRANTE: I fully agree. And I think
25	the nuance is you might even have your audience targeted
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1	correctly and say well, we are going to cover this topic
2	and miss what is it that they truly need to make their
3	jobs easier. I think that is part of the goal we had
4	in mind. And it goes both ways, definitely what Dr.
5	Stetkar was part of our intent.
6	So, this slide 19 includes some additional
7	comments that we provided in the memo where characterize
8	the issues within the working group within our own
9	words.
10	We wanted to indicate, as was brought up in
11	this discussion, that the challenges that we are
12	indicating are not to say issues are insurmountable.
13	We are dealing with uncertainty. We will continue to
14	deal with that. If an issue or hazard is important, it
15	should be addressed within the PRA and we do have
16	guidance, currently, to deal with it.
17	We are talking about improving in dealing
18	with issues that are going to come up, whether in
19	seismic, flooding, or mitigating strategies and how to
20	move on with those.
21	We also, as the NRC Working Group, believe
22	that a significant challenge we are dealing
23	particularly with external events is that irreducible
24	uncertainties are characterized as a hazard. And so it
25	is not always just an issue of maturity or bias, as might

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79 have been indicated, but it is also an issue of how do 1 we deal when the uncertainties are there, they straddle 2 3 our acceptance guidelines and that is really something 4 you have to deal with. And then ultimately, deal with 5 a balance between absolute and relative insights so that we don't get overly focused on either numbers, absolute 6 7 numbers or what the relative insights indicate in terms 8 of conservatism or not and those were delineated in the 9 memo. 10 So, in conclusion, on slide 20, we 11 hopefully presented an overview of what this working 12 group has worked on on the particular topic of treatment 13 of uncertainty. Aqain, we agree with the 14 recommendations that were provided by industry in the 15 white paper that were worked out over several months 16 within this working group's activities. 17 We accept that within the NRC purview of 18 activities that we recommended, that the Steering 19 Committee will deliberate and will decide on approval 20 of that. 21 And there is a very important point here 22 which is the authority of the working group went as far 23 as working together within different offices and

identifying issues, discussing the issues with industry and, ultimately, coming up with recommendations we

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could present to our management within our own understanding of words.

But once the issues have to be implemented and addressed, we have program offices that have different responsibilities, this will always cost resources and time. And so we need to think about a prioritization, short-term, long-term, actions we need to look into for more immediate help with particular issues as other things are floating around within this area. And so we definitely expect the Steering Committee to deliberate and then move on.

12 You know if an issue is with respect to 13 NUREG-1855, then the Office of Nuclear Regulatory 14 Research will have that responsibility to implement and 15 Of course, coordination across the offices is do that. 16 important but there needs to be a responsibility and a 17 decision in terms of resource allocation and 18 prioritization of what we can do.

19 thought the recommendations We were 20 We didn't recommend anything that we reasonable. 21 support, thought we couldn't of course. But 22 ultimately, when you are looking at a constellation of 23 issues, they have to prioritize.

And so, we recommend that these activities be considered for the Steering Committee and then the

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1	program offices take it on beyond this working group.
2	And hopefully, as I pass the baton to Sunil, he won't
3	have to lead this too much into the future.
4	And that is the conclusion of my
5	presentation. Thank you for your attention and if you
6	have any additional questions, please let me know.
7	CHAIR STETKAR: If not, as much as I would
8	really like to beat up on Mary, I have taken a straw poll
9	and we need to take a break.
10	MS. DROUIN: I only have three slides.
11	And if you all promise to just let me I mean, I am
12	just going to talk about
13	CHAIR STETKAR: No. Come on, Mary. I'm
14	going to lose bodies. So what I will do is we will take
15	a break until three o'clock.
16	(Whereupon, the above-entitled matter
17	went off the record at 2:43 p.m. and resumed at 2:59
18	p.m.)
19	CHAIR STETKAR: We're back on the
20	record. Mary, I'm sorry for the delay.
21	MS. DROUIN: That's quite all right.
22	Okay, I am here to just briefly talk to you about
23	the status of 1855. This was not a presentation on
24	1855. We have already done one of those.
25	So, just to remind you what were the

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82 objectives of 1855. It is to provide quidance on 1 2 how to treat uncertainties associated with PRAs that are used by a licensee or applicant to support 3 a risk-informed application. 4 specifically, guidance 5 And is so, provided in three areas: how to identify and 6 7 characterize the uncertainties; how to perform the 8 actual uncertainty analysis so that you can 9 understand the impact of the uncertainties on the 10 results; and then last, how to factor the results of the uncertainty into the decisionmaking. 11 12 So, those were the three areas that we tried to provide guidance in meeting our objective. 13 14 Okay, next slide. 15 A long time coming here with Rev. 1. We 16 encountered a lot of delays. They weren't 17 technical. The procedures for publishing NUREGs 18 are a lot more onerous than they were in the past. 19 CHAIR STETKAR: It's actually, the 20 final version of Rev. 1 is actually out. 21 MS. DROUIN: It is made public in ADAMS. 22 It has gone over to publications. Right now it is in the publication tech editing mode, where they do 23 the final check on style and format. But we had 24 25 agreed that we would not wait for publications

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1	because that could take three to six months.
2	CHAIR STETKAR: Yes, but it is publicly
3	available.
4	MS. DROUIN: It is publicly available
5	and that is the ML number.
6	CHAIR STETKAR: When did it show up?
7	MS. DROUIN: It was, let's see, it was
8	Monday.
9	CHAIR STETKAR: Oh, okay. Never mind.
10	Because when I went to look for it a couple of weeks
11	ago, it wasn't there. Thanks.
12	MEMBER BLEY: You can download it but it
13	says out for comment.
14	MS. DROUIN: When you get with that ML
15	number? Not the draft version.
16	CHAIR STETKAR: Let's not argue. I was
17	just curious because I looked for it.
18	MS. DROUIN: I mean I will go and check
19	because it is the final version.
20	CHAIR STETKAR: I looked for it a couple
21	of weeks ago but thanks.
22	MS. DROUIN: And as you know, Revision
23	1 was trying to better structure the guidance. So
24	that to look at the applicability of the NUREG is
25	the first section, the first stage. And then it

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1	looks at what is the scope and level of detail that
2	you need to support the application. And then it
3	gives guidance of what do you do when you have an
4	inadequate scope and level of detail. How do you
5	compensate for that?
6	And then it gets into the calculation
7	and identification characterization of your
8	parameter and your model uncertainties, looking at
9	your completeness, which also ties back into your
10	missing scope and level of detail.
11	Then, the last two chapters I keep
12	saying chapters and that is the old language. They
13	are now called sections and I just quite haven't
14	gotten my handle around that when they change these
15	rules on us.
16	So, the last two sections is looking at
17	guidance to the licensee that has provided adequate
18	justification. And looking at that, he has three
19	choices: he can redefine the application; he can
20	refine the PRA; or he can use compensatory measures
21	or performance monitoring as part of his
22	justification.
23	And this is looking into his scope and
24	level of detail are not adequate. Are his
25	uncertainties challenging acceptance guidelines?

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These are things.

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And then the last one chapter is the process that the staff uses for determining acceptability. And so some of the things that the staff looks at is the scope and level of detail of the PRA appropriate for the application. Is the PRA model technically adequate? Adequate in the sense that you may not have to meet everything that is in the standard for a particular application. How do the risk results compare to the

acceptance guidelines? How do the model uncertainties and parameter uncertainties impact the risk results? And is the acceptability of the application adequately justified?

So, based on that, a lot of things had happened. We had a lot of discussion internally about because of what was happening with this working group and the issues that were coming up and how well they were or were not addressed in 1855, should we hold up publishing Rev. 1 to further investigate this stuff and come back and improve 1855. And we came to the conclusion that no, let's get Rev. 1 out there. People can start using it and then we will undertake another revision.

We had a tabletop workshop back in

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November and there were a lot of good insights that came out of that workshop. And so we will start looking at that to how can we address those insights in a future revision.

We plan to hold a public workshop. We have already talked with EPRI. EPRI is going to co-sponsor it. And we are looking for the fall of 2015 to hold that workshop. I envision that that workshop will go through numerous, I say numerous, that is more than three examples of using this document and to see where there may be some gaps or where the guidance is just not clear enough or it is insufficient so that we can improve 1855.

There were a lot of questions that came out of that tabletop exercise. So, we will be working at this workshop to see if we can address some of those questions.

18 1855, for example, does have а 19 discussion on aggregation. And going through the 20 workshop, can we improve that discussion on 21 aggregation? So, we look at some good stuff coming 22 out of this workshop that we will be holding in the fall. 23

Fernando talked about a training course. That is different than the workshop. The

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training course is something, if you are familiar with the fire PRA training course that is held every six months, we are looking at something like that. It would be more in the lines of risk-informed decisionmaking and how treatment of uncertainty factors into that. But looking at trying to either take a current course and vamping it or perhaps creating a whole new training course. So that is something down the road in the future.

10 CHAIR STETKAR: Mary, before you leave 11 that thought, I read through the working group 12 recommendations, working your group 13 recommendations. There is a suggestion that a 14 pilot of NUREG-1855, Rev. 1 be performed and there 15 was discussion should it be performed before Rev. 16 1 is release or after. That is a moot point right 17 But there is this thing that says a pilot is now. 18 to be reversed to something less than a formal pilot 19 of an actual application but more than just a 20 tabletop exercise, in order to exercise the 21 practical implementation of the guidance.

How do these workshops relate to that notion of something between a tabletop exercise and a, I hate to use the term formal pilot, but a more comprehensive actual use of the guidance in an

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1	application?
2	MS. DROUIN: Well, that is where it is
3	right that this is going to be co-sponsored with
4	ERPI because what I envision and we are just right
5	now starting to think about this but in my mind,
6	we would identify at least three really good
7	examples, real-life examples.
8	CHAIR STETKAR: Let me ask you, though.
9	Are these examples to show people that here is an
10	example and here is the way it was done in the
11	context of that example or is it more of a pilot that
12	here is an example; you go use the guidance and
13	follow the guidance and show us the results?
14	MS. DROUIN: It is taking an example and
15	trying to use 1855 for that application and how well
16	does 1855 work.
17	CHAIR STETKAR: But is that done after
18	the fact, after you and folks from EPRI have worked
19	out the example and have the results, so that I, as
20	a student, look at that and say, uh-huh? Or is it
21	an actual training, where you give me the problem
22	and say here is the guidance and go use it, which
23	is more of the pilot-type process?
24	MS. DROUIN: Well, you know I think for
25	a workshop, and again, we haven't made any

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1	decisions, so don't take what I am saying as an
2	ultimate decision, but in my mind, we would take an
3	example and work it out. And then we would present
4	that at the workshop.
5	Now, that doesn't mean that that example
6	will come to a success. We may come through and say
7	okay, when we were doing this, we encountered this
8	challenge and this challenge. So, the lessons
9	learned is that 1855 doesn't really work very well
10	here and we would have to improve it.
11	CHAIR STETKAR: The only caution, I
12	would go, is I will bring you back to NFPA 805, which
13	was never piloted. And people say well, that is a
14	fundamental error that we made because it was never
15	piloted and it had all of these bugs in it and it
16	had all of the conservatisms in it and nobody can
17	use it because it was never piloted and it is too
18	conservative and whatever it is.

I don't know but it strikes me in the heat of getting NFPA 805 out on the street, the NUREG/CR-6850, in particular, back in 2005, that the team of the NRC and EPRI could have probably worked up some examples that show that the guidance in NUREG/CR-6850 worked pretty doggone well and showed that to people in a training situation and

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1	said see, it works fine. Here is how to use it. In
2	fact, people do that.
3	But that doesn't address the problems of
4	people actually, here is a problem. Use the
5	guidance. That is a different type of use of the
6	guidance.
7	And to see your conclusions from working
8	out an example with your experience and saying look,
9	here is an area where there might be bugs, it might
10	be completely different from my conclusions given
11	a problem and saying use this guidance and come back
12	or three of us, individuals, here is the same
13	problem, use the guidance.
14	MEMBER CORRADINI: Wouldn't you want to
15	do both? You would want to do the first one as part
16	of it and the second one you would have to do, so
17	that you
18	CHAIR STETKAR: But they are saying
19	don't do the second one.
20	MS. DROUIN: No, no.
21	CHAIR STETKAR: Well, that's what I
22	heard her saying.
23	MS. DROUIN: No, I'm not saying that
24	because I think that in doing an example up front,
25	I would envision not me doing that example, who is
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1	so familiar with this, but asking somebody else to
2	go through and try this example out and then tell
3	me where you saw problems. And then that would be
4	one of the examples that we would present. You know
5	here is somebody who used it; this is where they had
6	problems.
7	So, I would think
8	CHAIR STETKA: I would hope if it is
9	cast that way, I would feel a lot more comfortable
10	with it than just the team who is familiar with the
11	guidance and familiar with selecting, perhaps what
12	might be challenging, more or less challenging
13	examples, working through them and presenting them
14	in a tutorial fashion.
15	DR. FERRANTE: Yes, if I can add to
16	that, I am the guilty party on writing that
17	sentence. But the idea there was to say you know
18	the word pilot has been used more and more as a very
19	formal process, where regulatory impact will be
20	involved. And so we didn't want to say that is what
21	we are going to do because we are not there. I mean
22	I am not even sure how we will do that in NUREG-1855,
23	at this point.
24	But also to say we want more than to just
25	have another meeting where we say well, there are

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1	some of these issues floating around. Let's debate
2	them a little bit more. No, the idea was let's use
3	real examples and go through the guidance, as Mary
4	indicated, and as I think you indicated, and move
5	on.
6	But maybe that wasn't properly
7	characterized but we will take your advice and
8	present it carefully to the Steering Committee.
9	CHAIR STETKAR: I mean as long as
10	whoever exercises the guidance in the context of the
11	problem is not part of the team that developed the
12	guidance.
13	MS. DROUIN: I mean that was my vision.
14	CHAIR STETKAR: Okay.
15	MS. DROUIN: That was my vision.
16	CHAIR STETKAR: That is all I am talking
17	about here. When I think of a pilot, I don't get
18	into the nuances of what a pilot means in a
19	regulatory application sense. But when I think of
20	a pilot, I mean we feel confident enough the
21	guidance. Here are two or three different
22	problems. You as a not completely uninformed but
23	an intelligent practitioner, now go try to use this
24	guidance and go struggle with it.
25	DR. FERRANTE: And we understand that.

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1	CHAIR STETKAR: And what are the
2	lessons learned from that exercise?
3	DR. FERRANTE: Because it is an NRC
4	document and the pilot has developed it, we had to
5	address it in some manner. I mean the Risk
6	Prioritization Initiative had some of that debate.
7	So, that was really all this sentence was trying to
8	do.
9	CHAIR STETKAR: Okay, thanks.
10	DR. WEERAKKODY: Dr. Stetkar, the
11	example you took in terms of NFPA-805, I know Steve
12	is sitting quietly there, when we piloted 805, Steve
13	was there through those two pilots and I was also,
14	I had acting role in that. The question that you
15	asked recently seem to me in the sense that even
16	though we had to pilot plans
17	CHAIR STETKAR: No, Sunil, let me for
18	the record, NUREG/CR-6850 was not piloted before it
19	was used for Sharon Harris and Oconee, which were
20	the first actual regulatory applications of that
21	guidance. So, the guidance was not actually used
22	until someone was under the gun for a regulatory
23	submission.
24	I am talking about piloting the guidance
25	before that point,
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1	DR. WEERAKKODY: Point taken.
2	CHAIR STETKAR: while there is still
3	time to fix it up before anybody uses it.
4	DR. WEERAKKODY: Point taken. What I
5	was going to say is there are lessons that can be
6	learned from that experience. And perhaps, when we
7	pilot or when we go to the next step with 1855, use
8	that experience as a lesson learned.
9	CHAIR STETKAR: That is all I'm saying.
10	We have had other examples where we,
11	actually our subcommittees have been presented
12	things that have been characterized as a pilot.
13	And when you delve down deeper, it was the people
14	who developed the guidance ran through a couple of
15	examples using the guidance and decided that it
16	worked okay. Well, that is not very fair.
17	MS. DROUIN: No. We are in complete
18	agreement.
19	CHAIR STETKAR: Okay.
20	MS. DROUIN: That is all I had.
21	MEMBER SCHULTZ: Mary, with regard to
22	
23	MS. DROUIN: I'm done.
24	(Laughter)
25	MEMBER SCHULTZ: I have a question.
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With regard to Rev. 1 now out, has that revision
addressed, or to what level has that revision
addressed the recommendations that Fernando
presented associated with treatment of
uncertainty?

I think it has addressed a MS. DROUIN: huge amount. You know that last chapter did not really exist in Rev. 0, which gets into the decisionmaking process that okay, now the licensee has made their submittal and now how do you use that information in your decisionmaking now? Is it sufficient? This was done -- when you look at the first, Section 2 or whatever it is, which was the applicability of the NUREG, and we went through all the different types of risk-informed applications and where you could explicitly use this guidance and where the guidance was still generically good, it was more implicit than explicit.

So, where you have these gaps, there is probably going to be more work that is going to be needed to be done to provide better guidance than the little bit that we have in 1855, where we talk about how to use this generically for any decision. MEMBER SCHULTZ: But has that addressed the specific issues of aggregation, treatment of

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1	mitigating strategies and so forth? Has that been
2	done at some level? And if so, what level?
3	MS. DROUIN: It does. As I said, it
4	does address aggregation. Does it go far enough?
5	Probably not. There probably needs to be
6	additional guidance in there for that.
7	So mitigating strategies, no. Should
8	it be in this document versus some other place?
9	That is a decision that needs to be made. I don't
10	know that it belongs here.
11	MEMBER SCHULTZ: Why wouldn't it belong
12	there?
13	MS. DROUIN: I don't know.
14	MEMBER SCHULTZ: Okay.
15	MS. DROUIN: I don't know. I'm not
16	saying it doesn't belong.
17	MEMBER SCHULTZ: I understand. I
18	think I understand.
19	MS. DROUIN: There is a lot of decisions
20	that need to be made because I don't think 1855 is
21	the be-all and end-all for fixing everything that
22	is out there. As much as I would like to take credit
23	for fixing everything, I don't think I can.
24	MEMBER SCHULTZ: So, then, you said
25	there are some shortcomings and the way I see the

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picture going forward, then, as you are having the workshops with industry coming up, you are looking for -- the recommendation is that the working groups be sunset and will go to other activities, including the workshops. Is it intended that the workshops are going to address these issues at a higher level and move to create Rev. 2 or is it in combination with what we are calling pilot?

MS. DROUIN: Those are discussions among the offices of how do we move forward with these recommendations.

When you read the forward that is in 1855, we carefully crafted it because, as I said, we were debating about holding up Rev. 1 because there were some very good insights that came out of the workshop.

There were some issues that were raised 17 18 out of the working group. Should we hold up publishing this revision to address some of this 19 stuff? And we came to the conclusion, no. 20 Let's 21 qet it out. Let's get people using it because we 22 can always revise it. And we tried to say that in the foreword that we are looking to the future and 23 we recognize that there will be another revision to 24 25 this document. There may be multiple revisions.

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1	But we certainly believe there will be at least
2	another major revision to this document.
3	MEMBER SCHULTZ: My concern is I was
4	hoping that Rev. 2 would be the home for resolution
5	for these recommendations, these five
6	recommendations. And if we are going to say no, we
7	are not sure they belong in this document, then I
8	am a little concerned that they are going to be
9	resolved and documented appropriately.
10	MS. DROUIN: You know I can't speak for
11	my management and say this should be the home for
12	all of this stuff. So, I mean I can't say that. Do
13	I think it is the home for a lot of these?
14	Absolutely. But I still would not make that, say
15	that there still isn't other guidance that needs to
16	be developed that really should not be in 1855. It
17	certainly is related and maybe it is a regulatory
18	guidance maybe there is some regulatory guidance
19	that need to be developed. Maybe there is other
20	NUREGs. I mean these are things that as we get into
21	these issue, we need to decide where is the best
22	place.
23	DR. FERRANTE: Okay, if I can add to
24	that, I think some of the recommendations are
25	definitely a little bit outside of the scope of

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1	1855. What we tried to do with the recommendations
2	in 1855. 1855 has a lot of good additional
3	revisions that were made. How do we number one,
4	spread it to other documents so 1855 is not going
5	to be the place where Inspection Manual Chapters are
6	going to address everything. Maybe they will refer
7	to it or maybe we will incorporate it. That is a
8	decision to be made.
9	In other aspects, 1855 could be used as
10	a place to discuss certain things like, for example,
11	aggregation of different hazards. As the
12	probabilistic flooding evolves, what do we put in
13	1855 from that effort?
14	So, it can go either way. What we tried
15	to do when we were working to do beyond this is
16	inform the Steering Committee as to all these
17	issues. Where does things reside so that we can
18	resolve this? I mean we want a sense from this
19	working group because we don't want this working
20	group responsible for every work every other office
21	has to do. We think we ought to be able to
22	coordinate it. And we think we can do that if we
23	incorporate some of the training and the
24	discussions in the workshops but we don't want to
25	live in forever as a de facto lead of all things

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1	uncertainty. I think there needs to be a decision
2	from management of how that will be divided and then
3	apportioned, in terms of resources and so forth.
4	So, I hope that answers your question in
5	some regard.
6	MS. DROUIN: And take for example
7	aggregation. You know we do have some limited
8	discussion on that. The EPRI report is out. We
9	are looking more into it. As we go through our
10	workshop, maybe part of the lessons learned is that,
11	and I am just making silly examples here, but maybe
12	one of the examples learned is that what is in 1855
13	on aggregation is sufficient for 1855 but it needs
14	this other stuff done. Or maybe what comes out of
15	it is well, we need some more in 1855 on aggregation
16	so that you can truly deal with your decisionmaking
17	and your treatment of uncertainties but you still
18	may need something else. You know we just don't
19	know all of the answers to some of this stuff and
20	I think the workshop will help us make some of those
21	decisions.
22	DR. WEERAKKODY: With respect to the
23	management guidance on the recommendations, there
24	are some next steps that we are planning. Fernando
25	proposed at the last public meeting we sunset

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1	Working Group 2. Management did not agree.
2	What the management would like to see is
3	now that we have agreed with the industry we thought
4	of these recommendations, they are looking to the
5	working group to give some prospect, give some
6	priorities, resources, product, so that they can
7	make informed decisions.
8	And I could see a number of items that
9	is getting turned into actionable items in the
10	various processes we have but that is where we are
11	at. So, we are having those discussions internally
12	at this point.
13	MEMBER SCHULTZ: Thank you.
14	CHAIR STETKAR: Any other questions for
15	the staff? If not, thank you. It was probably
16	more than you expected but I think we had a good
17	discussion.
18	And I call up Doug True to present EPRI
19	or NEI, or industry, or however you want to
20	characterize Doug today.
21	MR. TRUE: Okay, good question. Yes, I
22	am Doug True from ERIN Engineering. I am here, I
23	think with three hats on.
24	CHAIR STETKAR: It is just it is a
25	public the only reason I brought it up is it is

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1	a public meeting.
2	MR. TRUE: It's a fair question.
3	I am here as Doug True from ERIN
4	Engineering. That's one hat. I think I am here,
5	to a degree, as the lead on the Industry Working
6	Group 2 to talk about some of our perspectives. And
7	I am not representing in any formal the working
8	group but I was the lead and I think I have a feel
9	for the industry perspectives on that. And then I
10	think I am here with a little bit of an EPRI hat on
11	supporting EPRI. Stewart Lewis wasn't able to be
12	here because he had a preexisting commitment.
13	But to talk a little bit about some of
14	the work we have done with EPRI on aggregation,
15	which ties in with this whole subject.
16	So, my slides have no format to them. I
17	use the blank template because I wasn't trying to
18	present any particular
19	CHAIR STETKAR: No, that's fine. I
20	just wanted to make sure because it is a public
21	meeting. We are on the record. If you are
22	representing yourself, that's fine. But if you are
23	representing one of the organizations, that is
24	something to be important on the record.
25	MR. TRUE: Now, distinguishing when I

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1	am speaking for me and when I am speaking for
2	somebody else may be a little harder but I think I
3	am wearing three hats today.
4	CHAIR STETKAR: Thanks.
5	MR. TRUE: Okay, so my title. I kept
6	the same title as I used at the RIC on this subject.
7	And John, I know you were there and maybe others.
8	And I have used this term before that uncertainty
9	I the hobgoblin of risk-informed decisionmaking.
10	And I like that because if I go and look up a
11	definition of what a hobgoblin is, at least one of
12	the definitions is something like a familiar but
13	troublesome elf. And I think that fits this
14	situation. We are very familiar with the fact that
15	uncertainties exist. We accept that they are there
16	but man, they can be troublesome.
17	And I want to talk about that in the
18	context of decisionmaking today and some of the
19	thinking that we have done on that as an industry.
20	So, I am going to cover a number of
21	topics. We will start with a couple of slides on
22	the Industry Working Group. I am not going to
23	repeat everything that Fernando and Sunil and Mary
24	went through but I will give you some of our
25	perspectives and give you an opportunity to ask

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anything about the industry's perspective on that.

I want to go back to one of the things you guys spent a fair amount of time on the first half of this, what I call the decisionmaker's dilemma. And I want to talk about that and the reality of that challenge that exists within the industry and within the NRC.

And then I am going to move into treatment of uncertainties, aggregations, some of the other things we have been doing in the EPRI work that was going on in parallel with Working Group 2 that we think helps advance some of the recommendations that Fernando presented earlier.

14 So, Industry Working Group, I have listed the main recommendations out of the working 15 We kind of grouped those into four broad 16 group. clarifying guidance, enhancing the 17 categories: 18 decisionmaking process, addressing mitigating 19 strategies, and education. And Fernando went through all of those for you. I won't spend any 20 21 more time on each of them individually.

But I think, and Joe Giitter talk to this a little bit, I think the industry feels there is an impending need to address these recommendations, given the ongoing post-Fukushima activities. In

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particular, we have got the fire work in 805 that 1 2 is coming slowly to a culmination, although it is going to get reworked here with new heat release 3 rates and we are moving down that path. Now, we are 4 going to be bringing seismic in on this for a number 5 External flooding is a key risk 6 of plants. 7 contributor or could be a key risk contributor at 8 some plants. So, we are going to be dealing with 9 these issues of more uncertain, more challenging, 10 more mitigating strategy-related maybe areas. And so I think we feel like there is some urgency or some 11 12 need to make some progress in these areas. And I think I actually would speak for 13 14 the Risk-Informed Steering Committee in that 15 regard, that the Industry Risk-Informed Steering Committee has been pretty strong in promoting this 16 working group and the risk interactions because of 17 18 the fact that we are going to be heading into these period of having to make decisions in areas that 19 20 become challenging with maybe respect to 21 uncertainty. 22 I created this at the request of one of the executives asking me to explain what all is 23 going on out there in uncertainty. And you heard 24 25 this morning from Mary about 1855 and we all know

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1	about Reg Guide 1.200 and 1.174, of course. The
2	standards have their role.
3	But then there is a whole other tier of
4	kind of lower level application-specific or
5	supporting guidance that also gets pulled in. And
6	those have been done in various pieces, sometimes
7	consistent, sometimes maybe not so consistent with
8	all of that. But as we move down this road of trying
9	to engage this hobgoblin of risk-informed
10	decisionmaking, I think it is important to realize
11	that we have got to make all these pieces work
12	together properly.
13	I will talk briefly to the industry's
14	role in this. Mary's led the NRC work on 1855.
15	EPRI has been working parallel to create some
16	companion documents for the practitioners on the
17	industry side to use to implement the
18	recommendations coming out of 1855. Those were
19	published a number of years ago.
20	And then just last week, I guess, EPRI
21	issued a new report on the term risk aggregation.
22	That document was actually being worked during the
23	Working Group 2 period of time. Garreth Parry, who
24	works for ERIN and I, has spent a lot of time on this
25	subject of how do we make some progress and get out

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1	what we hope is practical guidance and suggestions
2	on the subject of aggregation.
3	And as, I think, John, you pointed out
4	earlier, it is more than just a summation of
5	numbers. It is trying to understand what is really
6	under the hood and driving the risk.
7	And as part of that process, this is me
8	talking here, I actually believe there is a need for
9	another higher level document that really kind of
10	gets into risk-informed decisionmaking and ties the
11	industry side back into 1.174 and the actual
12	integrated risk-informed decisionmaking process.
13	We take some baby steps, maybe more than baby steps
14	in the risk aggregation report that I would like to
15	see taken a little bit further into how we actually
16	gave the integration of these inputs to make a
17	predictable decision so that the industry and the
18	NRC are kind of coming at this from the same
19	perspective.
20	I won't talk too much about that but
21	there is enough interest in the industry in that
22	idea that I was able to put it on the slide but it
23	is sort of my suggestion that we might benefit from
24	that.
25	This might be quite a bit of an eye chart

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1	but you guys have full-size printouts, I think.
2	CHAIR STETKAR: I'm sorry, on the
3	record oh, yes. And they help us a lot, too.
4	MEMBER CORRADINI: Can we blow these
5	up, too? Sorry.
6	CHAIR STETKAR: The good news is, there
7	is colors.
8	MR. TRUE: Yes, and so the colors mean
9	something. I will start with that, since you
10	brought it up.
11	So, blue was activities we thought were
12	so wait a minute. Let me back up.
13	So, Working Group 2 had all these
14	recommendations. I kind of divided them into four
15	pieces on that prior slide. And so we sat down and
16	said okay, if we want to move forward on these, what
17	does that really look like in terms of the process?
18	And this is not a plan. It is more of an outline
19	of what we think some of the actions might look like.
20	So blue bars are NRC activities, orange
21	bars are industry activities, and green bars are
22	joint activities, where we would coordinate
23	together in public meetings, workshops, pilots,
24	those kind of things.
25	So at the top, we have got clarifying

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1	expectations. I think we think that 1855 Rev. 1 is
2	going to be very helpful in getting those
3	expectations out there. I think we think that the
4	joint workshop that Mary talked about co-sponsored
5	by EPRI is a very useful step to get that socialized
6	in the industry, begin to gather some feedback
7	preliminarily, but most importantly, get the PRA
8	community conversant in what 1855 is expecting.
9	We like the idea of a pilot, and you guys
10	went through a whole discussion of what a pilot is
11	but I think it is an independent application, maybe
12	not in regulatory context but an independent
13	application of the guidance to see how well it
14	works. Whether that is one application or
15	multiple, we will have to decide.
16	And then once we get through that, then
17	come back and consider whether we need to revise
18	1855, update 1.174, or anything else coming out of
19	that process. And there may be industry actions to
20	update our guidance also.
21	The next aspect was a risk-informed
22	decisionmaking process. And the EPRI aggregation
23	report just came out. EPRI has two things planned
24	there. One is an aggregation pilot, again, to have
25	non-writers try to apply that guidance and advance

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the process that we espouse in that aggregation report. And then also have some public meetings with the NRC to begin to engage in a discussion about whether this is something that fits into the regulatory framework in some way in a time frame that is kind of parallel with the workshops and pilot applications of 1855.

And then I have the document that I put in the dotted lines on the prior slide would be that industry document on the integrated decisionmaking That is important because I think we have process. a big challenge with decisionmakers and I think that we can't focus only on the analysts and the practitioners in this context because our decisionmakers, and I will get into this in the next slide I think, come at this from the traditional decisionmaking sense and it creates a significant challenge for us as risk-informed applicants to get through that.

In the middle, I included all the --20 21 CHAIR STETKAR: A couple of things. 22 Number just the record, the one, on we, 23 subcommittee, did receive a copy of the EPRI 24 aggregation report. I don't know how many members 25 had a chance to read it but we don't typically

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	111
1	comment on industry reports unless they are
2	endorsed or accepted by the staff. So, any
3	comments that you might receive today on your slides
4	will be given in that context. But we aren't going
5	to review that report unless the staff basically
6	adopts it or does something.
7	The other comment, though, that I wanted
8	to make, your last comment was that the industry
9	document on integrated risk-informed
10	decisionmaking, you said that in the industry,
11	decisionmakers, I have forgotten the word you used,
12	use a classical or something like that
13	MR. TRUE: Traditional.
14	CHAIR STETKAR: traditional thank
15	you decisionmaking process. And earlier,
16	Dennis made the observation that all decisionmakers
17	somehow consider uncertainty, whether it is
18	explicit, or implicit, or ad hoc. What do you mean
19	by traditional decisionmaking process, a pure black
20	and white that if it is 9.999
21	MR. TRUE: Can we roll off to the next
22	slide?
23	CHAIR STETKAR: You have got a
24	beautiful graph.
25	MR. TRUE: Well, I may not get past the
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1	next slide but let me get through this one and then
2	we can stop and talk because I will follow in your
3	
4	CHAIR STETKAR: I was anticipating but
5	I just wanted to make sure that
6	MR. TRUE: Yes, and I can give you some
7	real-life, real-time, almost feedback on that exact
8	subject.
9	CHAIR STETKAR: I just wanted to make
10	sure that your notion of traditional decisionmaking
11	was, indeed, the next slide.
12	MR. TRUE: Yes, it is.
13	CHAIR STETKAR: Thanks.
14	MR. TRUE: So, in the middle, and I
15	won't go through every one of these boxes, but in
16	the middle are all the 2.1 things. And they are not
17	directly connected to anything else but I put them
18	in the middle because they are central to what is
19	happening here. We are going to be dealing with
20	these issues in a more significant way because of
21	those activities going on in this same time frame.
22	Down below, the education and training,
23	EPRI intends to put together a training module on
24	aggregation, which will probably be pointed at both
25	decisionmakers and practitioners. And then we

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1	have talked with the NRC about doing assessment of
2	what other work we have out there in training, in
3	education, to see if we can improve those going
4	forward. And then on the bottom, we have some
5	activities on mitigation strategies.
6	CHAIR STETKAR: Okay, you are going to
7	try to roll us through that real quickly and I'm not
8	going to let you.
9	MR. TRUE: Okay.
10	CHAIR STETKAR: Why is there this
11	apparent concern about not including mitigating
12	strategies in the context of the PRA? What is the
13	angst from the industry's or Doug True's
14	perspective?
15	MR. TRUE: I think there are a couple of
16	things. First of all, in my opinion, a kind of
17	quantitative analysis that is needed to understand
18	how, particularly, the portable equipment comes
19	into play in an accident scenario is not the same
20	as our traditional human reliability analysis.
21	In particular, it can be more of an
22	organizational response than as a distinction from
23	a human reliability action because take for
24	example, an impending flood that might involve use
25	of a FLEX-like strategy. If you have notice of that

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impending flood, the utility organization can spin up like no other. I mean you get resources like crazy. You get all kinds of management help in the process. And it is a very different response of the overall organization than an EEOP action or even maybe a SAMG action that we would normally try to look at in a traditional PRA.

EPRI has done a gap analysis of those kind of actions against the ASME Standard and there is an EPRI report on this and they have identified a number of areas where they believe there is further research needed in order to come up with what I would call a consensus method on how to quantify those responses. And again, my opinion now, I think that is going to take some time.

MEMBER CORRADINI: So, the reason is because it is portable and procedures are still in development that makes it different? I'm still trying to understand the essence of what makes it different.

21 MR. TRUE: I think portable equipment 22 is one aspect of it. The procedures will all be in place by the end of this year. By the end of 2015, 23 two-thirds of the plants will have physically 24 25 implemented FLEX, will have trained their

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operators, and will have procedures in place, which is another driver for wanting to do something short of this consensus method. It may take some more time.

The differences 5 are the portable equipment, the conditions under which the operators 6 7 are being expected to operate, potentially outside 8 getting portable equipment moved in potentially inclement conditions and the fact that there is a 9 10 broader organizational response that can influence the ability to accomplish that, both within the 11 12 utility and then even from the regional response 13 centers as well.

MEMBER CORRADINI: So, what I heard is the amount of variables are much broader and diverse than traditional methods for estimating.

MR. TRUE: In my opinion, I think the EPRI work kind of confirms that, too.

19 CHAIR STETKAR: You said there is an 20 EPRI report. Is it a publicly available report? 21 And if it is --

22 MR. TRUE: I knew you were going to ask 23 me that and I suspect that it might not be. 24 CHAIR STETKAR: But has been released.

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MR. TRUE: It is published. It was

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1	published at the end of last year.
2	CHAIR STETKAR: We can see if we can try
3	to get it. But as long as it is actually out, that
4	is what I was trying to establish.
5	MR. TRUE: Yes, it is a pretty
6	systematic review of the expectations you would
7	want to address in the PRA and treating it in the
8	PRA.
9	So, that is why I mention we have this
10	different kind of reliability analysis that we are
11	trying to do that is going to take some time.
12	MEMBER CORRADINI: So let me ask you a
13	slightly different question. So, let's say I have
14	installed equipment is qualified for some
15	environment and now I enter into this other
16	environment which is more challenging, inclement,
17	as you use the term, traditional methods can
18	estimate that?
19	MR. TRUE: I think for installed
20	equipment. We already credit non-safety equipment
21	in PRAs. So, this is another set of equipment I
22	don't see.
23	MEMBER CORRADINI: So, I will get
24	specific. So, in the accident in Japan, RICI ran
25	for one and a half days or three days and people were
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1	surprised. Would that current analysis have
2	caught that or it is just it was never considered
3	because it was not qualified for, as an example?
4	MR. TRUE: Yes, in the past, I think we
5	would have said that RICI would fail on the high
6	suppressionable temperature in most PRAs. I think
7	we have learned from Fukushima that might not be the
8	case.
9	We have also put in place procedures as
10	part of FLEX for RICI to keep suppressionable
11	temperature low, by the so-called anticipatory
12	venting, in order to give us an even better chance
13	that RICI lasts longer.
14	MEMBER CORRADINI: Okay, I understand.
15	Thank you.
16	MR. TRUE: But installed equipment I
17	don't see as being as big a problem. It is being
18	implemented in the same way we implement other
19	installed equipment. It may have different
20	qualifications. It may be subject to different
21	hazards but we know how to do all that part. It is
22	this other broader thing of the portable equipment
23	and the resources being brought to bear forward to
24	use those kind of other capabilities.
25	I lost my train of thought, too.

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1	Oh, the other thing is that the amount
2	of credit, in my opinion, the amount of credit you
3	are going to get for portable FLEX equipment is
4	going to be highly scenarioed because it is going
5	to be dependent on some of these inclement
6	conditions, the severity of the event, the actual
7	time line of the particular scenario you are trying
8	to credit it. And I believe that that is going to
9	create a splintering effect in the PRA to create new
10	accident scenarios that will, essentially,
11	complicate the model to not an insignificant
12	degree.
13	Computers take care of that. That is
14	not a problem. The computer can manage all of that
15	information but it is not an insignificant effort
16	to wire in in a realistic way where FLEX can help
17	you and where it can't. Whether that is in an
18	internal events context or it is in a seismic
19	context or in the other context.
20	So, there is a degree of complication in
21	that that is going to take some time to work our way
22	through. And then some utilities are already
23	working on that, looking into how it might be
24	incorporated. How far you want to go in that is a
25	function of how much you want to sharpen the pencil

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119 to get credit for it and what your plant's risk 1 2 drivers are also. We did a little study for Exelon, 3 looking across the fleet and for internal events, 4 just to see how might FLEX help, it varied quite a 5 bit across the fleet. In some cases it was maybe 6 7 ten percent kind of on the margins improvement. In 8 other cases, it was more like 30 or 40 percent for 9 internal events because this is a strong function 10 of the nature of the scenarios that are driving the risk for that particular unit. The more long-term 11 station blackouts you have, the better off you are 12 going to be with FLEX because that is really 13 14 designed for. 15 So, I don't know if I answered your 16 question, John. 17 CHAIR STETKAR: Yes, you know enough. 18 Thank you. So, in that regard, since we 19 MR. TRUE: are going to be at the end of this year with 20 21 two-thirds of the industry roughly implemented, we 22 are going to be engaging in regulatory interactions on issues and we know that the licensees are going 23 to be saying yes, but I have FLEX and it would have 24 25 helped me, well, we need a way in that interim period

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1	to say yes, this is how we are going to handle that.
2	So, the industry has proposed that this be one of
3	the focus areas for the Risk-informed Steering
4	Committee going forward.
5	Okay, let's talk about decisionmaking.
6	So, this is my attempt to frame this and I am going
7	to build it. I know you have it printed out but I
8	am going to build it for you to make a few points.
9	So, I think what I call the traditional
10	decisionmaking process or deterministic regime, it
11	is a very black and white process. There is an okay
12	and there is not okay.
13	We have some parameter that we are
14	checking. And when you do a conservative analysis
15	that we perceive as roughly bounding and we think
16	that is going to address our consideration of
17	uncertainties and we say okay, well, let's take 2200
18	degrees Fahrenheit, peak clad temperature.
19	Everybody knows that number. If I have a result
20	that is below 2200 degrees, I'm good. I'm golden.
21	If I have one that is above it, not so good. If I
22	have one that is just a little bit above it, that
23	is not so good either. And then if I have one that
24	is just barely below it, then I am okay. It's
25	magic. It's easy. The decisionmaker doesn't have

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1	to do anything. Just tell me that I am below.
2	I remember when I was with the utility
3	20 years ago and they were doing a control room dose
4	calculation. And I think the total dose limit was
5	something like, I don't know, 30 millirem or
6	something to the operators, and they came back with
7	a calculation that said it was 29.97. That was
8	good. We are done and everybody's happy.
9	So, here we are. We are embarking in
10	the industry
11	MEMBER BLEY: Well, before we leave it
12	there, Doug, it depends who you were talking to at
13	the time. But as you move around in an organization
14	and if it is something that could end up costing us
15	money, I suspect one gets questioned pretty hard
16	about what didn't you think about what might make
17	this a little worse than you think, what might make
18	it better than you think and you get pushed. And
19	if you go to a regulator, you might get pushed in
20	the same kind of way.
21	So, even though the criterion is clean,
22	the questions might not be. And at least to me, a
23	good decisionmaker always dig a little bit or he
24	lives in a continuous state of surprise and
25	amazement and eventually disappointment that the

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1	real world never turns out the way you guys say it
2	is.
3	MEMBER CORRADINI: Or he just hopes it
4	is the left-hand side and he knows for sure it is
5	always the right-hand side.
6	MEMBER BLEY: There are those, too.
7	MR. TRUE: I think certainly it
8	wouldn't be fair to characterize every
9	decisionmaker in this way. But I think that there
10	is a lot of stock taken in the fact that these are
11	conservative analyses.
12	MEMBER BLEY: I know they are
13	conservative, so I don't have to look any further.
14	MR. TRUE: And so if I have bounded it,
15	then why do I care that I am just almost at the limit?
16	It is close and that is okay.
17	MEMBER BALLINGER: Well, that is how
18	all the codes work. You know, the ASME code, if you
19	meet this limit, you are done.
20	MR. TRUE: If you used an accepted
21	method and you meet the limit, you met it.
22	So, 2199 is okay and 2201 is not okay.
23	And all of us can sit around here and say well, is
24	there really a big difference between those? No,
25	there is not but it was set up in a decisionmaking

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1	framework to make it straightforward, to make it
2	black and white.
3	MEMBER BALLINGER: Well as was Dennis
4	was saying, if somebody comes to me and says I
5	calculated a temperature of 2199, your BS detector
6	goes up just a little bit and you start asking
7	questions about where did that number come from.
8	MR. TRUE: Well, we don't fuzz those
9	lines, either. And when we do it, it is a very
10	bright line decisionmaking.
11	So, let's talk about on the
12	probabilistic regime. And we have a risk metric.
13	Here, we are trying to do this on a realistic basis.
14	So, already we have kind of moved away from the
15	decisionmaker's comfort zone that he is being
16	presented with a conservative result and we are
17	saying well, we are doing this realistically.
18	And so one of the solutions to that is
19	well, we will grade this area. We will call some
20	of it green, some of it white, some of it yellow,
21	and then we got the red, which is nobody wants to
22	be red. So, we put in some regimes. This is where
23	decisionmakers live.
24	And we put a number on there. And we
25	say, well, it is a mean value, less than ten to the
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minus six or between ten to the minus six, ten to the minus five, wherever we fall in that range.

And then we do a calculation. We start out with a mean value and then we might add an uncertainty distribution. Generally, we do. My experience, Dennis, is we pretty well do uncertainty analysis on all of the calculations. It is not that hard to do with the computer codes. mean parametric uncertainty is done pretty Ι systematically. It is also pretty uninteresting, to be honest, most of the time, because of the nature of the skewed distributions that we use; 95th tends to be less than a factor of three above the mean most of the time. You get surprised every now and then but it is an exercise we can go through.

And I think what Mary on 1855 has done 16 17 a nice job of doing is pointing out that the purpose 18 of doing all of that is to make sure that you are 19 getting the right mean. Because if you just put in point estimates that aren't actually means and do 20 21 a calculation, then that doesn't really tell you 22 If you have missed a state of knowledge anything. correlation and you are missing the correlation 23 between inputs, then you really get the wrong answer 24 25 in certain circumstances. But the focus of doing

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1	that is on getting the mean.
2	Today, most of the time I will do just
3	internal events perspective. The mean and the
4	point estimate value that we put in usually end up
5	within a very small margin between each other.
6	CHAIR STETKAR: I agree with you. You
7	keep narrowing it down. Most of the time for
8	internal events at power operation, core damage
9	frequency.
10	MR. TRUE: Yes, true. But even when we
11	get to seismic, for example, it is still a skewed
12	distribution. In fact your mean is probably even
13	higher on that distribution.
14	CHAIR STETKAR: True.
15	MR. TRUE: And this band is even larger.
16	CHAIR STETKAR: Right.
17	MR. TRUE: One of my concerns about this
18	from a decisionmaker's perspective is you show them
19	you have calculated a mean right here and that the
20	uncertainty distribution goes three or four orders
21	of magnitude down below them, they could be saying
22	well, why am I focused up here on top when it looks
23	to me like they are all this likelihood that it is
24	way lower than this. And I have had those
25	conversations with decisionmakers that you have to

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1	kind of work them through that process.
2	CHAIR STETKAR: True but is that a
3	problem? Do you view that as a problem? Only
4	because they haven't thought of it that way?
5	MR. TRUE: Only because they have not
6	thought about it that way.
7	CHAIR STETKAR: Okay.
8	MR. TRUE: And because they live on this
9	other side. Which all I got is this triangle over
10	there. I don't have this whisker.
11	CHAIR STETKAR: Well but I have had the
12	same discussion with utility clients. And you tell
13	them well, maybe if you have options, if your option
14	to reduce risk is to improve maintenance on a set
15	of valves that contribute X and do something about
16	sharpening your pencil on seismic analysis, which
17	also on a mean value contributes X, perhaps because
18	the uncertainty about the improvement of improving
19	maintenance on valves, you would bet that the risk
20	from the seismic stuff is a lot smaller. So, maybe
21	you would want to do something that is more
22	realistic that you can get your hands on. So, this
23	comparison is, if you talk to people, these
24	comparisons often make a lot of sense. Yes, if I
25	got a limited amount of money, I would have put it

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1	an area where I am more confident I can actually
2	measure a real benefit as opposed to a paper
3	benefit, if you will. Or something that maybe I
4	can't control at all, which might be the uncertainty
5	in the hazard, which I have absolutely no control
6	over whatsoever.
7	MR. TRUE: Right. Right, which drives
8	a lot of that to
9	CHAIR STETKAR: I was just curious if it
10	is a problem, is it a problem in terms of
11	MR. TRUE: I think it is a problem in
12	that they start on the left side and they are used
13	to a simple answer.
14	CHAIR STETKAR: Right.
15	MR. TRUE: And even if it is not 2199, if
16	it is 2100, it is just a symbol. And now we are
17	asking them to get their hair around this whole
18	issue of okay, it is this number but you said it
19	might be this and it might be that. That is a whole
20	new challenge for them and they all came up. Every
21	one of them, that I know of, came up through the
22	deterministic side of the house and now we are
23	taking them into this other decisionmaking regime.
24	And then we get into the trickier one
25	where okay, my mean is below. So, if I was on the

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1	left-hand side, I am good. I am in the okay region
2	but my upper bound is slightly above. So, am I
3	white or am I green? And in my experience, they
4	have a really hard time with this.
5	And we had what I have referred to within
6	ERIN as a near-death experience, literally with the
7	company. Because we had a large client who went
8	into an SDP and we had done a calculation and the
9	results came out at nine times ten to the minus
10	seven. They went into the enforcement conference
11	and said the answer is nine times ten to the minus
12	seven and in responding to an RAI, we found out that
13	the code we were using to do one of the calculations
14	had a glitch in it and actually we came at about 1.1
15	times ten to the minus six.
16	That utility executive felt that their
17	personal integrity had been challenged by the fact
18	that our result changed from nine times ten to the
19	minus to 1.1 times ten to the minus seven because
20	they had gone to an enforcement conference and said
21	that it was nine and not 1.1.
22	And we went back and were able to sharpen
23	our pencil in a few other areas in the analysis and
24	we got the answer back and all of a sudden everything
25	was fine. The executive didn't even care anymore.

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1	At the moment that we crossed that
2	threshold in any way, shape, or form, that was a big
3	deal. And it is a very real challenge. I mean this
4	is not about that individual executive. It is just
5	the way it is in the decisionmaking process.
6	MEMBER BALLINGER: So, he was treating
7	it like the left side.
8	MR. TRUE: Yes, absolutely. This is
9	why the education aspect that Fernando talked about
10	is so important and I think some of your earlier
11	points.
12	So, now, okay, we have done the
13	uncertainty analysis, mostly parametric. We come
14	over and we take that same result and, under 1855,
15	we start to look at some modeling uncertainties and
16	we find out, wow, we have some new results. And
17	most of them are kind of clumped around where the
18	mean was. One now suddenly has jumped up into the
19	one times ten to the minus six hole. What do I do
20	about that as a decisionmaker? It is above. It is
21	in the black part or the bad part. So, what do I
22	do?
23	Well, it depends. That calculation
24	might have been a bounding calculation. We don't
25	really think it is that bad. But that whole process
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1	of how do I and industry decisionmaker and I suspect
2	it is true in the NRC, too, making those decisions
3	is a big deal.
4	And then heaven forbid that we do a
5	sensitivity that actually goes outside of the 95th
6	percentile, which may seem like an unlikely thing
7	but, depending upon what you are looking at, it can
8	actually happen.
9	CHAIR STETKAR: Let me interrupt you
10	right there because you keep saying we do a
11	sensitivity. I can do a sensitivity that will put
12	you off above the word probabilistic on your scale
13	there. It could be a silly sensitivity but I can
14	do any kind of sensitivity analysis. That is why
15	we have tended, your subcommittee has tended to
16	downplay the usefulness of sensitivities in lieu of
17	doing a real uncertainty analysis, where you can say
18	yes, there might be a tail that goes up there but
19	it is not a number that is a result of you know
20	if I assume a beta factor is 0.9, I could call that
21	a sensitivity analysis but it is sort of a silly
22	sensitivity analysis because we know it is not.
23	MR. TRUE: Right and I think we should
24	have this discussion.
25	So, that is part of what 1855 and the

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EPRI companion documents try to get at is these are the nature of the modeling uncertainties and these are the types of sensitivities you should do. So, you are not doing stupid sensitivities. You are doing sensitivities that are consistent with what 1.174 says, which is that it has to be a reasonable alternative hypothesis that has a roughly equivalent likelihood of being true.

So, I will give you an example. I wish Professor Corradini was here. Core melt progression modeling. MAAP has one way of doing it and MELCOR has another way of doing it. Those two ways give you totally different RCS response, suppression pool response. As we have gone through the CPRR work, we have found that those kind of things have a big impact. They have a big impact on things like how the vessel depressurizes. Ιf you believe MELCOR, it is one way. If you believe How effective is the MAAP, it is another way. suppression is one way; it is another way.

The truth probably is neither one of them is probably perfect but we have to look at those as reasonable alternative hypotheses. I can't go off and put a distribution on every one of those core melt progression parameters but I can go into my

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1	risk model and say well, if I am wrong and the SRVs
2	are never going to stick open, even though MELCOR
3	would predict and the SOARCA work would predict they
4	will, is that going to say I made a bad decision?
5	And so in that context, I think I,
6	personally think, that sensitivity studies are
7	actually extremely valuable to the decisionmaker
8	because they can illuminate the insight, whether it
9	is for or against the decision you are making,
10	rather than burying it in a distribution.
11	So, I think there is an important role
12	for sensitivity.
13	CHAIR STETKAR: And I agree in that
14	context. I do. I think that there is a role for
15	sensitivity studies.
16	I think that over reliance on what
17	people call sensitivity studies in areas where we
18	can actually address uncertainty in a reasonably
19	straightforward manner, that is the area that I have
20	concerns about because I have seen that. I think
21	they have all been misused in other ways.
22	MR. TRUE: And I am guilty I will
23	admit to being guilty even in that regard.
24	CHAIR STETKAR: I have done it, too.
25	MR. TRUE: But it depends on the problem

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you are trying to solve.

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I suspect we may get in to talk to you about the CPRR at some point, and I will have a slide on this, if I ever get to it, where we did a lot of sensitivities in lieu of doing the full uncertainty analysis. And that was just a decision we chose.

We did have a conversation, though about

the parametric uncertainties. And if they are not giving us a whole lot of new insights and we are a long way from our decisionmaking threshold, then spending a lot of time to go through and do a propagation of those uncertainties, in my mind, is not maybe the best use of resources. I might better try to understand my sensitivities to some of these other inputs to make a better decision, make sure my decision is robust, in light of those kind of uncertainties but we may agree to disagree on that.

So, I think this is an important slide. I came up with it last week because I was thinking about this. It tries to capture what we are really dealing with in the decisionmaking. I suspect that it happens inside the NRC. I can guarantee that it happens on the industry side.

24 MEMBER SCHULTZ: So Doug, there is a middle 25 picture you might -- or we might consider, and that's

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1	best estimate LOCA or whatever you want to call it.
2	The approach is they use a different
3	approach than the conservative analysis for your for
4	your lefthand box there. It's where the methods,
5	approach, and the way in which the uncertainty
6	evaluation would be done, and what criteria would be
7	used to set new limits.
8	That's kind of the intermediate profile
9	which in fact has been accepted by the regulator and
10	industry as a way in which to get inside an approach that
11	looks at at the problem and its solution differently.
12	MR. TRUE: Yes, it is it is a third way.
13	I would contend that it's a different flavor of a
14	conservative analysis.
15	MEMBER SCHULTZ: Right.
16	MR. TRUE: But it does have a structure
17	MEMBER SCHULTZ: I am not saying it fits
18	into the righthand
19	MR. TRUE: No
20	MEMBER SCHULTZ: Side
21	MR. TRUE: No no no
22	MEMBER SCHULTZ: But
23	MR. TRUE: But
24	MEMBER SCHULTZ: It does fit between the
25	two.

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1	MR. TRUE: It does fit between the two,
2	it's a different
3	MEMBER BLEY: That's kind of interesting
4	because I think of it the other way.
5	I mean, best estimate with uncertainty
6	MEMBER SCHULTZ: That's right.
7	MEMBER BLEY: is in fact a probabilistic
8	treatment.
9	MEMBER SCHULTZ: That's right.
10	MEMBER BLEY: So to me, it's the right
11	side. It might not be a PRA, but it's still a
12	probabilistic treatment of both the the limits and
13	the the calculation of where you expect to be, and
14	it generates a distribution, effectively.
15	MR. TRUE: Effectively, and then we make
16	the decision
17	MEMBER BLEY: Well not effectively, but it
18	does.
19	(Laughter)
20	MR. TRUE: based on the we make we
21	make the decision based on the 95th percentile in that
22	case, so it's in that sense, it is more conservatively
23	biased than the mean, if you believe the mean is within
24	the 95th, in that case.
25	But yeah, it could be that could be a

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1	third one.
2	I think the challenge in trying to do that
3	that is for a very specified set of calculations that
4	you can control all those inputs in a particular way.
5	The problem with a nuclear power plant PRA is there are
6	so many inputs that trying to control that in that same
7	way I think would be a challenge, if we tried to have
8	converge on a metal fab.
9	I personally think that that the
10	integrated decisionmaking process is where we should
11	start to bring all this to bear, that that the risk
12	information shouldn't be a check mark of okay/not okay,
13	that it really ought to be information that's provided
14	to the decisionmaker in the context of other information
15	on defense in depth and safety margins and performance
16	monitoring to create a truly integrated decision, which
17	is where we're where we're going in the EPRI work.
18	Okay, so oh, I got even a higher one
19	so I got another one that's even higher. And then
20	then we introduce this idea, well, we'll fuzz up the
21	decisionmaking lines. And I am just not convinced that
22	that actually helps in the decisionmaking process.
23	And I know and I have was a party to
24	1855 and the work that was done there, industry comments
25	on it, and I accept that they are fuzzy because 1.1 times

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1	10 to the negative six is no different than nine times
2	10 to the negative seven, but telling a decisionmaker
3	it's fuzzy there doesn't really help them deal with this
4	other dilemma of
5	MEMBER BLEY: Well it strikes me it's the
6	bridge to your next slide, which says if you end up in
7	those areas, then let's take the next step, which is your
8	next slide.
9	MR. TRUE: Yes.
10	Okay. So in this I mean, this is getting
11	now into the EPRI report on aggregation, and what we have
12	what and this report, I will say, was written as
13	much or maybe more for industry practitioners of PRA
14	than it was for anyone else because there are a lot of
15	misconceptions and misunderstandings about
16	uncertainty, mean values, and decisionmaking in the
17	industry that we have to work through, and I think I
18	would I would reckon that the same things exist on
19	the on the NRC side too.
20	But the PRA results are the product of
21	simply a model. They're it's not reality, it's our
22	best shot at constructing a model, but it contains
23	uncertainties and the analytical biases that went into
24	that. Some of those biases may be conservative, some
25	of them may be non-conservative, but but they exist,

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138 and the results need to be interpreted in the context 1 2 of the fact that this is a model that contains both those uncertainties and biases. 3 We think 1.174 outlines a really nice 4 5 integrated decisionmaking framework to help address those uncertainties where PRA is one input to the 6 7 process along with the others. 8 I think too often, we're considering PRA as 9 either the input or an irrelevant input, so the PRA 10 practitioner thinks well I did a calculation that shows 11 the risk is low, I am done. The deterministic person 12 says I don't really care about your PRA calculation, my 13 defense in depth is more important. 14 And what -- I think that where 1.174 and I think a lot of our other integrated decisionmaking 15 16 process documents stop short is how do you actually 17 bring all that together into a truly integrated 18 decision? And that's what we've tried to begin to work 19 on in this aggregation report. 20 So it gets into making sure you've -- you've 21 identified uncertainties and characterized them 22 properly, quantified them properly where you can, 23 you're aggregating those results, you're interpreting 24 those results appropriately and then taking it into a 25 decisionmaking process.

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1	So in aggregation, I used to I used to
2	be in the camp of, you know, these answers are quite
3	different, and just adding adding them together is
4	you know, is kind of misleading because you're adding
5	an apple, an orange, and a banana. And they're not ever
6	all round they they're all different elements in a
7	decisionmaking process.
8	But I think where I have come to in the last
9	five or six years is we have to accept that summing the
10	mean values is going to come, or involving them in a
11	mathematical sense, so it's it's going to be a natural
12	outcome, and even if I write them down on a piece of
13	paper, or I write them down on four different pieces of
14	paper, people are going to mentally add those numbers
15	together and you're going to get to the same point, so
16	pretending like you shouldn't add them, or declaring
17	that you should never add them, is just denying a
18	reality.

And so I think we have to accept that we're going to have to sum the mean values.

But the sum shouldn't be used as anything more than a relative indicator. It's just giving you 23 an indication of the approximate regime in which your results are -- are in.

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And the actual insight and how you make a

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140 decision come from the actual disaggregation of those results into the scenarios that are important to the decision that you're making, and not the top line number summation, whether it's a total CDF or the delta CDF or it's an ICDP. If we rely strictly on numerical criteria,

ignoring the uncertainties we're across those contributors, how the \_\_\_ how those different contributors may be treated in terms of their level of realism, because sometimes, frankly, PRA analysts take don't model stuff or model shortcuts. We it conservatively because we don't think it's going to be important, but yet, when we come to a decision, sometimes it ends up being important.

And so the degree of realism is going to vary, even in the very best PRA, and -- and so we need a process that will accept that.

18 And then I believe there are some in here, 19 margins in the quantitative acceptance guidelines, the CDF and LERF and delta CDF delta LERF values that we 20 21 typically use, and I want to talk a little bit about that 22 in a second here, and that the real valuable information 23 is not the number that comes out of the PRA, but all this 24 lower-level information that can help the decisionmaker 25 understand this.

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1	So let's talk about acceptance guidelines.
2	So the QHOs are the NRC's policy on acceptable risk. In
3	general, they translated those into the LERF and CDF
4	metrics.
5	18 NUREG-1860 has an appendix that did
6	a nice job of basically demonstrating that based on
7	NUREG-1150 maximum, those guidelines are appropriate,
8	that in other words, if you made a decision on the
9	CDFs from one times 10 to the negative four, you should
10	be confident that you're not challenging those QHOs.
11	But NUREG-1150 is 30-year-old technology,
12	pushing 30-year-old technology. We've all learned a
13	lot from that. There's been a lot of advances into
14	accident research since NUREG-1150.
15	And so one of the appendices of the EPRI
16	report includes this chart, which is which takes on
17	the lefthand side the slashed bars, the NUREG-1150 max
18	results, which are the same things that were in
19	NUREG-1860, and said if I have a CDF of 10 to the negative
20	four, my latent cancer risk would be the upward green
21	bar there. If I had a a LERF of 10 to the negative
22	five, then my individual fatality risk would be the left
23	blue bar, left blue slashed bar.
24	If you take the average value out of
25	NUREG-1150, the average conditional risk, which is the
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probabilistically -- probability-weighted average of 1 those results, it drops by an order of magnitude or more, 2 and if you look at SOARCA, we found on the individual 3 4 early fatality risk side that the max and the average 5 are much closer together and much, much smaller. In fact, our margins are much, much greater than maybe we 6 7 perceived they were. Whereas the latent cancer risk is 8 down from NUREG-1150 by an order of magnitude or more, 9 but we have considerably more margin in any of those 10 contexts. 11 Now, I will be the first to admit that 12 SOARCA was a stylized set of calculations, but I'll also 13 point out that, for example, it did do some pretty severe 14 It did early contaminant failure, a liner events. meltthrough in a Mark I, it did ICE LOCA for a PWR, so 15 16 those are what we would normally have considered and 17 what NUREG-1150 would have considered the most extreme 18 source terms, and now we have the SOARCA analysis that 19 shows that when you use the best values we can and the 20 state-of-the-art consequence analysis, the results are 21 actually quite a bit larger. 22 MEMBER BLEY: So how come the -- I had never 23 noticed this in what SOARCA has got, how come the average 24 went up compared to 1150?

MR. TRUE: Probably because 1150 treated

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1	more scenarios. I just took the average of the of
2	the SOARCA scenarios, which is only a handful of
3	scenarios.
4	MEMBER BLEY: Yes, okay.
5	MR. TRUE: So
6	MEMBER BLEY: And they were all they
7	were all severe scenarios?
8	MR. TRUE: Yes, they were all intended to
9	be sort of challenging scenarios.
10	Now, I am not arguing that we should change
11	the subsidiary objectives. I don't think we should
12	raise it to 10 to the negative four, 10 to the negative
13	five. That is not my point.
14	My point is that when we come to
15	interpreting those, I think this is provides a
16	rationale to say that those don't need to be bright
17	lines, they don't need to be hard-and decision
18	points, ceilings in a sense in the decisionmaking
19	process, because if you're a little above, if you're at
20	that 1.1 times 10 to the negative six that that executive
21	was so concerned about, you know, it's all the margins
22	are substantial enough that we shouldn't get too tied
23	up over those kind of of points.
24	So, like I said, there is an appendix in the
25	EPRI report that describes how we did this calculation,
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1	and I think it it probably merits some more
2	consideration because SOARCA is a little bit a little
3	bit, quite a bit stylized, and it only looked at a
4	handful of scenarios. It probably merits some further
5	investigation, but to me, there is an indication that
6	we have probably more margin than we than we typically
7	thought.
8	I think most people think if you exceed 1
9	to the negative four, you're challenging the QHOs, and
10	I think this shows that that may not actually at all be
11	the case.
12	(Off mic comment)
13	MR. TRUE: Well, they if you the
14	policy statement says that it's the NRC's policy on
15	acceptable risk.
16	Applying it on a plant-specific basis, and
17	there are all policy issues associated with that, but
18	what it says in the policies.
19	So this slide I think I have pretty well
20	said in my a knife-edged treatment, or and the
21	uncertainties, we don't get need to get too hung up
22	on, you know, a sensitivity case that's just taken
23	that's a little bit above or even a 95th percentile
24	that's slightly above a decision threshold.
25	MEMBER CORRADINI: So I guess I'll ask my

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1	question.
2	MR. TRUE: Yes.
3	CHAIR STETKAR: Mark asked me whether we
4	can teach old dogs new tricks. Apparently, a lot of
5	them, but not all of them. Sorry.
6	MEMBER CORRADINI: So so if we were to
7	use that logic, then a lot of the actions we've just
8	recently taken we didn't need to take because we never
9	made the QHOs for for an operating plant, right?
10	MR. TRUE: A lot of the actions we took.
11	MEMBER CORRADINI: Mitigated strategies,
12	they I can look at all the risk analysis I have, and
13	I don't all of these were taken because of not
14	because they passed the QHOs.
15	MR. TRUE: No, I think there are other
16	reasons. I am a risk analyst, as you know, but I
17	don't believe that PRA is the is the only input into
18	a decisionmaking process, and in fact, I would take some
19	amount of credit for the whole idea of FLEX from the
20	industry perspective.
21	And and I think it made a lot of sense
22	as as a tool, or toolbox, a set of capabilities to
23	help plants be able to deal with the unexpected because
24	the unexpected does happen, even if the risk
25	calculations is is low.

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1	MEMBER CORRADINI: I'll turn myself off
2	now.
3	MR. TRUE: Okay.
4	I'm going to tease you a little bit on some
5	of the EPRI CPRR work. That report is also out, by the
6	way, and I gave the reference there in the bottom left
7	corner of these slides and some of the back-up slides.
8	But we did we we took this whole issue
9	of uncertainties to heart as we were doing the CPRR, and
10	we did investigations of 14 different areas of
11	uncertainty or sensitivity, addressing plant-to-plant
12	variabilities across the Mark I fleet, risk model
13	uncertainties, you know, the inputs to the the PRA
14	part of the risk model, sur-accident, phenomenological
15	uncertainties, and then consequence modeling
16	assumptions, because those are most of those are less
17	uncertainties as they are, you know, we wire in an
18	assumption and Max does the calculation.
19	And we ran over about 150 different
20	sensitivity results, so the whole calculation out to
21	latent cancer, financial risk results for for all
22	these different sensitivity areas, and I presume we'll
23	be back at some point to talk to you you folks about
24	that, so I don't want to spend a lot of time on it, but
25	just sort of to say that, you know, not only do I think

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147 uncertainties are important, but in -- in making a 1 2 decision like this, I think it's very important that we 3 -- that we extensively consider what we think are 4 important --5 CHAIR STETKAR: Doug, since you have the EPRI reference in the lower left-hand corner there, has 6 7 Volume II of that been published yet? 8 MR. TRUE: Volume II is not published, it's 9 \_\_\_ 10 CHAIR STETKAR: Okay. 11 MR. TRUE: -- we're working on it. 12 CHAIR STETKAR: Some of us were looking for 13 it. 14 MR. TRUE: Yes. 15 CHAIR STETKAR: And it's not there. 16 MR. TRUE: Yeah. 17 CHAIR STETKAR: Okay. 18 MR. TRUE: It's not -- it's now the --19 CHAIR STETKAR: Okay. 20 MR. TRUE: -- the EPRI has decided to stage 21 them because there was a big demand for the first one, 22 and the --23 CHAIR STETKAR: Okay. 24 MR. TRUE: -- second volume is going to be 25 a lot bigger, and --**NEAL R. GROSS** 

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1	CHAIR STETKAR: Yeah, it's got the
2	appendices and the actual calculations.
3	MR. TRUE: It's got all the calculations,
4	right, yeah, yeah.
5	So Reg Guide 1.174. It has the five
6	elements of the decisionmaking process, I don't need to
7	explain that at all to you, and it calls for an
8	integrated decisionmaking process.
9	And as I alluded to or even said before, I
10	think all too often, we get siloed a little bit too much,
11	and the risk analyst wants to only focus on their one
12	element, and the deterministic people want to focus only
13	on their elements, and I I think it's time, from a
14	maturity perspective, that we begin to actually move
15	towards this integration of the decisionmaking
16	integration of the decisionmaking process.
17	And I am putting that shoe
18	MEMBER POWERS: Well in
19	MR. TRUE: squarely
20	MEMBER POWERS: truth in truth, the
21	whole idea of the integrated decisionmaking process has
22	been it would not be done by the PRA analyst or the
23	deterministic analysis, but it would be made done by
24	the decisionmaker themself.
25	And, I mean, I think when we wrote 1.174,

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1	we recognized the PRA analyst is always going to believe
2	his PRA, the deterministic guy is always going to
3	believe his deterministic outcome, and there's not
4	anything you can do about that. It's the decisionmaker
5	that does the integrated decision process.
6	MR. TRUE: I think that that is that was
7	probably the intent of of 1.174. It's what I believe
8	1.174 says. Not always clear to me that that's the way
9	we actually have implemented it, so
10	
11	MEMBER POWERS: It is absolutely clear to
12	me that that's the way it is never done.
13	(Laughter)
14	MR. TRUE: Good, so
15	MEMBER POWERS: It has never been done in
16	by the intent. It's not always the decisionmaker's
17	fault, because I think you were a little vague about
18	integrated decisionmaking in there.
19	It is more the the project that's key
20	than any other single part of 1.174, but yeah, I have
21	I think what happens is the onus points the other way,
22	and the decisionmaker makes his decision and appeals to
23	one of the places, the boxes you pointed to, as the basis
24	of his decision.
25	I mean, I I think the integrated

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150 decisionmaking has not been done the way it 1 was 2 envisioned when we wrote 1.174, but it may not be anybody's fault because we didn't word it very clear 3 4 what we meant. I couldn't agree with you more 5 MR. TRUE: I think that -- I actually think, every 6 on that, Dana. 7 time I go back and read 1.174, I am impressed with the 8 level of thought that was put into it. 9 Ι think it is pretty high-level, 10 particularly when it gets to this point, and sort of what 11 we're saying in this EPRI aggregation report is let's 12 qo, take this a little bit further, and let's try to 13 actually move ourselves towards a more truly integrated 14 picture, because right now, we're just giving the 15 decisionmakers snapshots, in my perception, we give 16 them snapshots and then they've got to pick which person 17 they want to rely on. 18 MEMBER CORRADINI: So, but --19 MR. TRUE: And that's not productive for 20 the industry or the -- or the NRC. 21 MEMBER CORRADINI: So, I am trying to 22 understand, so your point is to develop some sort of 23 integrating process for all of these things for the decisionmaker? 24 25 MR. TRUE: Yes, to present to the

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151 1 decisionmaker --MEMBER CORRADINI: Make his or her job 2 3 easier? MR. TRUE: Yes. 4 5 MEMBER CORRADINI: Do we really want to Somehow, then, they're going to 6 make it easier? 7 eventually -- they are going to essentially default back 8 to your left-hand view of reality. 9 What I guess I am trying to say is the fact 10 that it is complex, and it's never going to become any 11 less complex, and there is uncertainty, so it's almost 12 important to kind of make it fuzzy and hard for them. That's why I am trying to understand what your --13 14 MR. TRUE: I think --15 MEMBER POWERS: But once you've ---- yeah. 16 MR. TRUE: 17 MEMBER POWERS: -- made a decision, Mike, 18 I think you ultimately become the left-hand side. 19 As soon as you make a decision --20 MEMBER CORRADINI: Well yeah, you have to 21 make --22 MEMBER POWERS: -- when it becomes --23 MEMBER CORRADINI: -- black or white, you 24 have to --25 MEMBER POWERS: -- left-hand side, because

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1	there's an okay and there's not okay
2	MEMBER CORRADINI: Right.
3	MEMBER POWERS: once you've made a
4	decision.
5	MEMBER CORRADINI: Yeah.
6	MEMBER POWERS: So I think it evolves in
7	that direction.
8	And I think I mean, fundamentally, I
9	believe when we left when we handed people Reg Guide
10	1.174, and it really was very much a product of ACRS
11	thinking and whatnot at the time, is we left them vague,
12	and because they're vague, the the arrows in reality
13	point the other direction.
14	And what Doug is saying is okay, what we
15	really wanted to do is point the way they were drawn,
16	and he's going to try to figure out a way to do it, and
17	I have a tendency to say GFL, but
18	(Laughter)
19	MEMBER POWERS: because I I mean, I
20	lived through this, and I know how difficult it is.
21	MR. TRUE: I think it is difficult, but I
22	I guess I I think I want to give the staff credit
23	here, because I think that they have done a number of
24	things over the years to try to move us in that
25	direction.

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1	I think LIC 504 takes a really good cut at
2	thinking about all the elements in this decision and
3	putting it in front of the decisionmaker.
4	I think Appendix M, although it has got its
5	vagueness as well, of the STP process is another thing
6	that tries to look at the different elements.
7	And so I guess, you know, this may be a pipe
8	dream, but but I think we should try to see if we can
9	move that guidance
10	MEMBER POWERS: Pipe dream it may be, and
11	be prepared for getting half a loaf instead of a full
12	loaf, but if you're doing I mean, progress is
13	progress, I mean, just anything you can do to help move
14	things.
15	But when we when we see people coming in
16	and saying well let's put an extra filter on in the name
17	of defense in depth because I think it's a good idea,
18	I think we're not doing things by an integrated
19	decisionmaking process.
20	MR. TRUE: Okay. I'll try and move
21	through this to get to some more of the of the meat.
22	So so the integrated you know, try to
23	get to an integrated process, not a linear set of gates
24	and I've got to check the box that each of these inputs
25	are okay or else I can't make a decision, or I I

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1	default my decision.
2	And we need to do that in the context that
3	understands the strengths and limitations of the
4	inputs, in particular PRA.
5	It's going to require decisionmakers
6	understand the elements and that they understand the
7	implications of those, and so ultimately there is a
8	decision to be made. This is not a cookbook. This is
9	not a recipe. Ultimately, there is a decision to be
10	made, but I think that I think we can frame this in
11	a way that can be more straightforward for the
12	decisionmaker to be able to make that more integrated
13	decision.
14	So in the EPRI report that you all got late
15	last week, we we proposed a what we termed a rubric.
16	It's a little bit of a perversion of the of the term
17	rubric, but that comes from education, I think, and it's
18	it's basically a standard way in which you would look
19	at problems to try and bring bring the results to a
20	conclusion.
21	And it it I think we tried to build
22	off of the principles described in other guidance, like
23	LIC 504 and Appendix M and other industry documents. It
24	tries to bring together the risk information and other
25	elements, and most of all, from the standpoint of the

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1	decisionmakers I know in the industry, we tried to
2	capture the high-level summary in one page, because
3	that's about the amount of attention we get.
4	Now there needs to be more build-up to get
5	that to that one page, and we didn't get into all the
6	details of how you might do that, but when we ran this
7	by the industry through the EPRI membership, and the
8	owners groups, people felt like there was something here
9	that we could probably move this process forward so that
10	we characterize our risk information on the top and we
11	bring together the other elements of the of the
12	integrated decisionmaking process on the bottom.
13	Opted to use color-codings. I have gotten
14	various inputs that you're crazy to use color-coding
15	because it has meaning to people, but I think that it
16	does have meaning to decisionmakers, and that's why we
17	would carry forward that.
18	And I think I have an animated one next that
19	kind of walks you through what this is, so so this
20	rubric, and we in the document, there are three or
21	four of these we put together, one, this one, was on
22	overall CDF, so we're trying the purpose of this
23	calculation, we characterize the the various risk
24	contributors, and the different color blocks relate to
25	different traditional hazard groups of the of the

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1	calculation.
2	For each of those contributors, we
3	characterized the modeling in terms of whether it's
4	fully realistic, whether it's got a conservative bias,
5	or it was done in a bounding manner because
6	CHAIR STETKAR: Before you do that
7	MR. TRUE: Yes.
8	CHAIR STETKAR: I have studied this, and
9	for the life of me, I can't understand what the bands
10	mean, so could you
11	MEMBER BLEY: I thought it was just
12	summations.
13	CHAIR STETKAR: So could I am stupid, so
14	could you explain to me what the blue on the bottom
15	means?
16	MR. TRUE: It's just a stacked bar of risk.
17	CHAIR STETKAR: It's just a stacked bar,
18	okay, and the
19	MR. TRUE: So
20	CHAIR STETKAR: height of
21	MR. TRUE: whatever blue is, internal
22	events, is
23	CHAIR STETKAR: And the
24	MR. TRUE: at one point, something times
25	10 to the negative five, and the red, which is probably
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1	fire, is whatever the height of that is.
2	CHAIR STETKAR: Okay, but
3	MR. TRUE: Something
4	CHAIR STETKAR: but the top, the little
5	thin green thing on the top, is just the the delta
6	between the this is a little green thing above that
7	subsidiary that you can't even see, but it's no, you
8	can't see it, but it's it's there. It's internal
9	flooding.
10	MR. TRUE: It's external flooding for that
11	
12	CHAIR STETKAR: Or, I am sorry, external
13	flooding.
14	MR. TRUE: Yeah, yeah. That's actually a
15	slice from external.
16	CHAIR STETKAR: Yeah.
17	MR. TRUE: So the top of the stacked bar is
18	the total risk, which is in this case
19	CHAIR STETKAR: Whatever it is.
20	MR. TRUE: 1.1 times 10 to the negative
21	four.
22	CHAIR STETKAR: Yeah, right.
23	MR. TRUE: And the and then the
24	CHAIR STETKAR: And
25	MR. TRUE: constituents are shown.

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1	CHAIR STETKAR: And the external
2	MR. TRUE: It's a pie chart shown in a
3	linear form
4	CHAIR STETKAR: Yeah, okay.
5	MR. TRUE: right, that's what a stacked
6	bar is.
7	CHAIR STETKAR: All right.
8	MR. TRUE: I personally like stacked bars
9	in this context better than pie charts because it gives
10	you a sense of where you are relative to some numerical
11	
12	CHAIR STETKAR: I get it, I get it.
13	MEMBER BLEY: The only thing for me with it
14	is you are looking for since we have the scale on the
15	left side, you're looking to that scale
16	CHAIR STETKAR: Right.
17	MEMBER BLEY: but it really only applies
18	to the top
19	CHAIR STETKAR: Right, right.
20	MEMBER BLEY: bar, and to the bottom
21	CHAIR STETKAR: Right.
22	MEMBER BLEY: usually.
23	CHAIR STETKAR: The little thin slice that
24	you can't see up there is really small on the absolute
25	of course, zero is a really small number too, but if

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1	you stacked it in terms of relative contributions
2	MR. TRUE: You mean reorder it?
3	CHAIR STETKAR: Yeah.
4	MEMBER CORRADINI: I assume it would be
5	CHAIR STETKAR: That's that's what I was
6	trying to make it, but I got
7	MEMBER CORRADINI: I assume just the
8	bottom is the thing that they always know, and all the
9	other stuff on top is added into what the internal events
10	are. That's why you put internal events at the bottom.
11	MR. TRUE: Yeah, I think the yeah, it was
12	arbitrary the order I put it in, to be honest, but I mean
13	we usually start with internal events, and then we've
14	spent a lot of time on fire, and now I added seismic,
15	and internal flooding, I guess, and so it was there
16	was no method to the
17	CHAIR STETKAR: Okay.
18	MR. TRUE: ordering. I think they're
19	all the same because I used the same Excel spreadsheet
20	to do it.
21	MEMBER CORRADINI: And what is you're
22	going to tell us when you have a yellow conservative,
23	a green realistic, what does that mean?
24	MR. TRUE: Those colors were just to help
25	draw the eye to the fact that, okay, if it's realistic,

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1	it's, then you
2	MEMBER CORRADINI: Or in other words
3	MR. TRUE: what we expect
4	MEMBER CORRADINI: the internal event
5	is more realistic than the than the internal fire one?
6	MR. TRUE: Yes.
7	MEMBER BLEY: So those labels go with the
8	bars.
9	MR. TRUE: With the bars, yeah.
10	CHAIR STETKAR: I'll let you get to the
11	word "uncertainty" before I ask the next question.
12	MEMBER CORRADINI: John studied this
13	you're talking about this in terms of the bars, in terms
14	of conservatism
15	MR. TRUE: Each of those contributors
16	CHAIR STETKAR: Okay, you're not going to
17	do more than what you present here on the word
18	"uncertainty"?
19	MR. TRUE: Well, there would need to be
20	as I said, this is the high-level summary for the
21	decisionmaker. There would need to be more information
22	on each of these hazard groups that would be available,
23	but this is what we were going to this is what this
24	is a start at what we're
25	CHAIR STETKAR: See I actually, you know,

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1	in terms of my understanding, I finally sort of figured
2	out what the colors and you know, the mean value
3	stuff, conservative, realistic is somebody's
4	subjective interpretation of what those words mean.
5	But what does the what is high
6	uncertainty compared to moderate uncertainty, for me as
7	a decisionmaker? Is high uncertainty I don't know,
8	a factor of 10,000 in the 90 percent confidence
9	interval, where moderate is a factor of 1,000? Or is
10	it those are very very, very very subjective terms
11	
12	MR. TRUE: Yes.
13	CHAIR STETKAR: where on this mean
14	value, we've got these color codes, and we're slicing
15	that so thin that we know within a fraction of 10 to the
16	negative five what those numbers are, and yet over the
17	the uncertainty range, we've got these very coarse,
18	subjective, you know, things that I don't even know what
19	they mean. So why did you decide to do that?
20	MR. TRUE: I was trying to put it in the
21	language that the decisionmaker could could manage
22	more clearly, or more simply, but it could be done in
23	it could be done numerically, we could do a range
24	factor, we could do
25	CHAIR STETKAR: Range factor I don't

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1	understand. If you give them two or three, you know,
2	the 90 percent confidence intervals, the 5 and the 95
3	are the median or something like that, I think they can
4	relate to those things to show that something is really
5	big and fat versus
6	MEMBER CORRADINI: I think all you're
7	trying to say is that with the I mean
8	CHAIR STETKAR: With the qualitative
9	MEMBER CORRADINI: with the qualitative
10	or the "qualitative" word, there has got to be some
11	attached quantitative range, that's what you are
12	CHAIR STETKAR: Yes, there would have to,
13	because see the typical a typical person might think
14	that a factor of 10 in my 90 percent confidence interval
15	is a huge amount of uncertainty
16	MR. TRUE: Right, and we all know that's
17	not true.
18	CHAIR STETKAR: And you and I know that's
19	not true, but if this is being cast for your typical
20	decisionmaker, if you would
21	MR. TRUE:: I think those are all
22	CHAIR STETKAR: I
23	MR. TRUE: appropriate admonitions that
24	we need to will need to get this nailed down so that
25	it's clear when we designate something as being

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1	CHAIR STETKAR: Well, and
2	MR. TRUE: x or y, that that that's
3	what it means, and but I am loath to I think execs,
4	my experience with execs is they have a hard enough time
5	with the whole negative exponent thing to begin with,
6	and
7	(Laughter)
8	CHAIR STETKAR: But that's exactly
9	MR. TRUE: And then and then adding on
10	top of that all of these other numerical factors is
11	you lose them really fast.
12	CHAIR STETKAR: But there has been there
13	are pictorial ways of showing this that actually show
14	the distributions and the fact that this contribution
15	might have a mean value that's fairly high, but but
16	the whole distribution is very broad.
17	Those are pictorial. They don't have to be
18	precise and numerical. They are pictures, you know,
19	it's the summation of of the different contributors
20	that people often display, and I have at least been able
21	in clients to to point to that and say oh, yeah, okay,
22	I get it, now I understand that this is really broad
23	uncertainty compared to this.
24	MR. TRUE: Okay.
25	MEMBER CORRADINI: No, I want to go on to
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1	the next slide, why don't you go on?
2	MR. TRUE: Let me just reiterate what I
3	think I said at the beginning.
4	What we are trying to do is start the
5	dialogue on how we can get this kind of information,
6	whatever form it takes, into the into the hands of
7	the decisionmaker in a simple form that they can start
8	to then know, okay, I need to start asking questions
9	about this area, because you're telling me there is
10	uncertainty here, and it seems like it's kind of
11	important to my decision.
12	So what what we're trying to do, and I
13	certainly don't believe in the amount of work we did on
14	this that we've resolved everything, but but I am
15	encouraged by the fact that you you must see enough
16	in it to think that there is something we could do to
17	start bringing information to
18	CHAIR STETKAR: I'll bring you back to the
19	fact that we don't review anything. I just happened to
20	have read, personally and and, you know, these are
21	my observations, personally.
22	MEMBER CORRADINI: Since you're asking
23	just for an off-the-cuff observation, my only feeling
24	is that so this is what you use as a I hate to use
25	the word "tutoring" tool, but as some sort of

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1	explanatory tool for a decisionmaker in this regard,
2	right?
3	MR. TRUE: Yeah.
4	MEMBER CORRADINI: So my only thought is
5	that depending upon the individual, have you tried this
6	out with anybody?
7	MR. TRUE: I have not sat down
8	MEMBER CORRADINI: I won't use the word
9	decisionmaker, but a pilot decision
10	CHAIR STETKAR: You, as a matter of fact.
11	MEMBER CORRADINI: Well, I am not a
12	decisionmaker.
13	MR. TRUE: We did we did circulate it
14	within the industry
15	MEMBER CORRADINI: Okay.
16	MR. TRUE: it was more focused on the PRA
17	community. Actually, it was circulated
18	internationally, too, which is a whole interesting
19	conversation because risk-informed means a different
20	thing in other countries than it does here.
21	So that that was we got some
22	interesting feedback on that.
23	But the so we have we have, this isn't
24	just us authors' opinions about this, but we got some
25	good feedback. I think the general feedback was, you

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1	know, it seems like we could do some more here, and
2	that's all we're really trying to to do in this report
3	is to is to start a dialogue on that.
4	There are some other props in the document
5	about how you come up with the color schemes when we get
6	down here on the bottom, about defense in depth and
7	safety margins that are intended to to help the
8	decisionmaker probe in the areas where they they
9	should probe, where there where there is softness,
10	because I every summer, I teach that PRA course to
11	executives at MIT, and in one of the courses, one of the
12	one of the attendees said to me, can you give me
13	something that can help me test my PRA guys to see if
14	what they're telling me is really robust?
15	You know, how do I how do I know that they
16	are actually telling me the straight-up story on those?
17	MEMBER BALLINGER: I don't think he used
18	the word "robust," I think I remember that.
19	MR. TRUE: Yeah, it probably was not a term
20	I should put on the public record, but and I think
21	so I think there is a on the decisionmakers' side,
22	I think they are looking for, okay, all this stuff and
23	all these numbers and the negative exponents involved
24	and everything, this is this is you know, how do
25	I really get my head around this in a way that I can make

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1	a you know, be sure I am making a good decision?
2	MEMBER CORRADINI: But I mean the reason I
3	asked the question about because to get back to Dana's
4	point, if eventually, when you make the decision, you
5	go from the mushy side of your diagram, with a lot of
6	color, to the black-and-white side, it seems you almost
7	have to test drive this with a couple of individuals that
8	you trust so they will give you the unadulterated, yeah,
9	I get it, but Sam or Mary will never get it because they
10	don't do this thinking process.
11	Because I don't think one size fits all. I
12	think to the extent that you're going to do this and try
13	to educate these guys, it would be it would be you'd
14	almost have to have multiple ways of providing or
15	displaying the same information. Otherwise, you could
16	get the wrong decision. You could they immediately
17	would jump to black-and-white when you don't want them
18	to, they want to basically appreciate the differences.
19	That is why my only thinking is that you
20	might want to test drive it with a couple individuals
21	you trust.
22	MR. TRUE: I think that's good. And what
23	we what EPRI, and this is on that little flow chart
24	thing I presented earlier, EPRI wants to do some pilots
25	of this to try it out, and I think that would come out
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1	of be one of the things we'd look at in that process,
2	is to put it in front of some decisionmakers.
3	MEMBER BLEY: It would be nice to if I
4	were in your spot, and doing that, it would be nice to
5	come up with two or three different kinds of displays
6	and see how they work rather than just doing one, or
7	using it on different people and then trying it
8	MR. TRUE: Yes, good, good.
9	Okay. So our goal is that and this I
10	said a couple times here this is the starting point
11	to try and move move things forward.
12	So the summary is as much, I think, for
13	for you all as it is or maybe less for you all, more
14	for the overall community.
15	I mean, I have had industry analysts come
16	up to me and say well, you know, if we give a margin to
17	the QHOs, then, you know, why can't we just use mean
18	values? What the heck? Why do we even need to consider
19	these uncertainties? And that is exactly the wrong way
20	to look at this.
21	We have a responsibility to honestly
22	understand and characterize those to help our
23	decisionmakers understand what's underneath those
24	results, and and not be hung up on acceptance
25	guidelines being a hard limit, which I think 1855 is a

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1	huge step in that direction, and move towards a more
2	integrated decisionmaking process.
3	And we feel like we've made some progress,
4	but there's still work to do.
5	So I think that when we get to the bottom
6	line of this, the that a risk-informed regulatory
7	decision creates an integrated set of insights that we
8	can't really get through any other means, certainly
9	through just simply traditional deterministic means, or
10	even through just using a risk-based approach.
11	So I think anything we can do to gain that
12	promise by making this more understood, integrated
13	decisionmaking process, would be a positive thing, so
14	that's it.
15	MEMBER CORRADINI: I think he's done.
16	He's done.
17	MR. TRUE: I think I am done.
18	CHAIR STETKAR: Any other questions for
19	Doug, comments?
20	(No audible response)
21	CHAIR STETKAR: If not, Doug, thanks a lot.
22	My I look forward to perhaps an eventual opportunity
23	where we can actually formally, you know, give EPRI
24	comments, or give the staff comments on this. We'll see
25	how it evolves.

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1	MR. TRUE: Yeah, I hope so.
2	CHAIR STETKAR: Because as I said, this is
3	anything you heard today is just literally
4	off-the-cuff individual comments from members because,
5	first of all, we didn't receive it until late last week
6	
7	MR. TRUE: Yeah
8	CHAIR STETKAR: second of all, we don't,
9	you know, we don't typically review these things, but
10	
11	MR. TRUE: Okay.
12	CHAIR STETKAR: And anything else for
13	Doug?
14	(No audible response)
15	CHAIR STETKAR: If not, thanks.
16	What I need to do now is ask if there's
17	anyone in the room from the public, or even if you're
18	not public, if you'd like to make any comments, we'll
19	entertain that, and we're hopefully getting the
20	bridgeline open.
21	It is open. I have been told the
22	bridgeline is open, and I must ask a favor of anyone who
23	is out there. If you're out there listening, just
24	please say hello or something so we confirm it's open.
25	MR. LEWIS: Marvin Lewis

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1	CHAIR STETKAR: Hi hi Marvin, thank you
2	very much.
3	Now, if any members of the public do have
4	comments, would you please identify yourself and state
5	your comments?
6	MR. LEWIS: Marvin Lewis
7	MR.CHAPMAN: Can you hear me? This is Jim
8	Chapman sorry I didn't get through
9	CHAIR STETKAR: Okay, Jim
10	MR. CHAPMAN: earlier.
11	CHAIR STETKAR: Okay, Jim, we've got it
12	sounded like both you and Marvin may have comments, so
13	Jim, if you have comments, start.
14	MR. CHAPMAN: Well the first thing is can
15	you hear the music in the background?
16	Second is I thought it was an excellent
17	exchange of ideas, and I'm going to go on mute now, so
18	have a great Tuesday.
19	CHAIR STETKAR: Thank you. And we could
20	not hear your music, so thanks.
21	Marvin, did you have comments?
22	MR. LEWIS: Yeah, I was just thinking
23	CHAIR STETKAR: Marvin, you're Marvin
24	you're you're fading in and out. Are you on a
25	speakerphone? If you are, could you just use the

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1	handset?
2	MR.LEWIS: I cut out the speaker. Can you
3	hear me better now?
4	CHAIR STETKAR: That that is much, much
5	better. Thank you.
6	MR. LEWIS: Okay.
7	Look, here here's what I'm thinking.
8	Every time I have had problems like that, and I tried
9	to get a computer program for my arithmetic, for math,
10	for that matter, to work, I used to go back, and I would
11	find something that works.
12	In other words, okay, here, look, here
13	here they made something, and it works, and everything
14	there's the numbers, and there's how they did it.
15	Has anybody gone back and tried to figure
16	out risk-informed for say Clinch River, Three Mile
17	Island Number 2, and Arkansas Number 1, the crane drop
18	over there?
19	What is the risk-informed numbers on that?
20	What would how what is are your numbers
21	predicting that on that day, that these cranes might
22	drop a a stator through the ceiling of a switchgear
23	room and cause a station blackout that was three hours
24	away from a meltdown?
25	In other words, you're doing it in air.

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1	You're not going back and trying to find hard cases to
2	test your numbers against.
3	Am I making myself clear as mud?
4	CHAIR STETKAR: I I think I understand
5	your comment, and I appreciate that.
6	Anything else?
7	MR. LEWIS: Oh, a million and one things,
8	but I don't think I should bring them out because it
9	could get heated.
10	All right?
11	CHAIR STETKAR: Thank you, Marvin, I
12	appreciate that.
13	Is there anyone else out there who would
14	like to make a comment?
15	(No audible response)
16	CHAIR STETKAR: If not, we'll re-close the
17	bridgeline so that because it pops and crackles on
18	our end, that's the only reason that we do that.
19	And as we usually do in a subcommittee
20	meeting, I would like to go around the table and see if
21	any of the members have any comments or final
22	recommendations?
23	Mike? Yes.
24	MEMBER CORRADINI: No, I just thank the
25	staff and and Doug for their presentations, but other
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1	than that, I think I have asked all my questions. I
2	don't have any final comments.
3	CHAIR STETKAR: Thank you. Ron?
4	MEMBER BALLINGER: I have sort of opened
5	your line
6	CHAIR STETKAR: It is.
7	MEMBER BALLINGER: I have sort of a naive
8	question, and that is if a decisionmaker is obviously
9	asked to make decisions in the presence of uncertainty,
10	that is a little bit on the subjective side as to how
11	much uncertainty he is willing he or she is willing
12	to tolerate, if you will, but nonetheless, that decision
13	has to be defended before the regulator.
14	So how does that work? Because when that
15	person goes before the regulator and says I have made
16	this decision, then the regulator has to decide whether
17	or not they agree with that, given and I am sure the
18	decisionmaker is going to have to say here's the
19	uncertainty that I am dealing with, and here's the
20	amount.
21	So I am just I mean, it's something that
22	has to be done, but I am just curious as to how that is
23	likely to likely to play out because there's another
24	iterative loop that's probably going to play going
25	to happen.

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1	You're the PRA experts, I am not, so
2	CHAIR STETKAR: You're asking you're
3	asking me to solve the problem.
4	MEMBER BALLINGER: Okay, well?
5	(Laughter)
6	CHAIR STETKAR: I agree with you, but I
7	think that's what that's the intent of this whole
8	process
9	MEMBER BALLINGER: Yeah.
10	CHAIR STETKAR: is is to make sure
11	that all of the decisionmakers, not not just, you
12	know, if if you're wearing your utility hat today,
13	the utility decisionmaker and the regulator both have
14	access to the same information developed according to
15	the the same guidance so that that both sets of
16	decisionmakers, if you want to characterize it that way,
17	can can actually examine that, you know.
18	And indeed, your your level of risk
19	tolerance, you know, my example of 10 percent chance of
20	exceeding a value, might be troublesome to me, but a 30
21	percent chance of exceeding it might be fine to you, but
22	at least if we have the same information, we can then
23	deliberate internally with our own organizations and
24	discuss it, you know, between the organizations,
25	whether it's acceptable.

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1	MEMBER BALLINGER: I just I am just
2	curious how that plays out with the public interaction,
3	whereas where if a utility or a licensee comes in and
4	says we will accept an uncertainty of pick your 10
5	percent, and the regulator says well, we would prefer
6	that you deal with 15 percent, but we'll accept 10
7	percent, and then the public interaction comes around
8	and says well wait a minute, we have two numbers here,
9	which one is right?
10	Is that a dumb question
11	CHAIR STETKAR: Any other comments?
12	MEMBER BALLINGER: is that a dumb
13	question?
14	CHAIR STETKAR: It's not, it's not a dumb
15	comment. It's it's what what the what the
16	industry and the regulator and the staff need to
17	struggle with.
18	MEMBER BALLINGER: Yeah.
19	CHAIR STETKAR: It is. I mean, that's the
20	whole reason that, you know, I think the fundamental
21	reason that this exercise is ongoing right now,
22	especially in light of of, you know, more attention
23	on seismic events and and external flooding, and to
24	some extent fires, which there are a lot broader
25	uncertainties.

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1	MEMBER RYAN: You kind of hit on what's
2	been rolling through my head, which is the consequence
3	part I am sorry.
4	CHAIR STETKAR: Push the button.
5	MEMBER RYAN: I have been thinking about
6	the consequence side of it.
7	So if you've got an event that's fairly
8	likely with very low consequence, that's a whole
9	different story than an event that's very unlikely that
10	has very significant consequences, so and you said
11	that many times in this meeting, Ron, that I remember,
12	that you know, you can't take one versus the other, you
13	have to take the whole system and think about, you know,
14	consequence and risk.
15	So I just I just remind ourselves that
16	that is very important, at least in my thinking, how to
17	understand both parts.
18	Thank you.
19	CHAIR STETKAR: Thank you.
20	Dr. Bley?
21	MEMBER BLEY: I too appreciated the
22	presentations and discussions today.
23	I might follow up Ron's question with just
24	a couple of comments.
25	My experience has been that when we tell the

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1	truth in dealing with the public and acknowledge what
2	we know and what we don't know, we have a much better
3	chance of reaching an agreement than when we pretend
4	things are absolutely fixed, and they know they're not.
5	And so I my experience has been that we
6	come out of those discussions much better than if we
7	if we don't carry them out.
8	There is no right or wrong between your 10
9	percent and 15 percent. There are differences in how
10	people evaluate these things.
11	I was pleased where I hear industries
12	trying to push ahead, I was pleased with where the staff
13	is going, and I think they're kind of in the same
14	direction in addressing these issues.
15	I was a little disconcerted by some of the
16	comments that that want cookbooks in places where I
17	don't think that's going to be helpful to us.
18	So I look forward to seeing how this
19	progresses.
20	MEMBER BLEY: Dr. Powers?
21	MEMBER POWERS: You aren't getting nowhere
22	if nobody calculates.
23	PARTICIPANT: Can you repeat that?
24	MEMBER POWERS: This won't get nowhere as
25	long as nobody calculates what the uncertainties are.
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1	MEMBER BALLINGER: Can you just repeat
2	that, louder?
3	MEMBER POWERS: This will get nowhere as
4	long as people don't calculate the uncertainties, as
5	long as we just get point values on these things, you're
6	wasting your time. And that is what we have been
7	getting.
8	CHAIR STETKAR: Steve?
9	MEMBER SCHULTZ: Yes, I'd like to thank
10	both the staff and the industry for the presentations
11	today.
12	I think the presentations represent some
13	some real progress associated with this area of work,
14	and I think it demonstrates the value of the working
15	group and the the working groups and the activities
16	they have been pursuing.
17	I agree with Dana. This is it's an
18	important avenue to follow and to assure that
19	uncertainty is not only considered, but it's it's
20	calculated, it's brought forward, it's part of the
21	decisionmaking process.
22	But I thought the discussions really
23	demonstrated that things were could move forward in
24	a very productive way, and I think it's very promising
25	what we've heard today from both the staff and the

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1	industry.
2	I appreciated the perspective that was
3	described in terms of how this might move forward,
4	maintaining this understanding that there there is
5	the analysis side of this, and there's the
6	decisionmaking side of this, and and that's that's
7	very important to continue to recognize as we move
8	forward with the workshops, the whatever we're going
9	to call them in terms of trial trial runs with the
10	methodology and the philosophy of moving this process
11	forward.
12	I think it's we ought to look forward to
13	it with with some real with some real enthusiasm
14	because I think it it is the right way to go, and as
15	both NRC and industry suggested today, the time is
16	right. It's really important at this point in time,
17	with all the progress that's being made with the
18	operating plants, and one would hope what we would want
19	to have for the newly licensed plants, new the
20	licensing process for new plants that this takes shape,
21	takes form, and moves to an application phase in some
22	way.
23	CHAIR STETKAR: Thank you.
24	And I also, I'd like to thank the staff and
25	Doug, whatever hat you were wearing when you were
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1	talking. I think it was a good discussion.
2	I would echo Dennis's closing remarks about
3	cautioning against trying to develop guidance or
4	criteria that are too prescriptive in terms of how it
5	shall be done or how a decisionmaker shall make the
6	decision or what criteria should be used.
7	I recognize there is a need for some better
8	elaboration, as Doug put it, of that integrated
9	framework. I think there's there's an awful lot of
10	promise in that area.
11	And I think that, you know, as you can tell,
12	there is some interest among the subcommittee members
13	on the topic. I think that I know I have been
14	following it for the last year sort of under the radar,
15	and it seemed to be about the right time. You know, you
16	had the big working group meeting back in November of
17	last year, and it seemed to be about the right time to
18	sort of bring it to the subcommittee now.
19	If there is indeed, and Doug mentioned, if
20	the industry feels there is a need to sort of get this
21	out and on the street because the industry sees a need,
22	there's always a need from the staff's perspective, I
23	think.
24	We should probably keep in good contact and
25	think about when to schedule the next subcommittee
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1	meeting.
2	I think, you know, as you get closer,
3	whether it's the industry or the staff, to getting
4	something in terms of I don't want to call it
5	guidance, but, you know, whether it's insights on what
6	enhancements might be made to 1855 or whether it's an
7	idea of a of a separate set of guidance from the
8	from the staff's perspective, if you if the staff and
9	the industry come to closer consensus on adopting some
10	of the principles in the EPRI document, I think that
11	would be very very interesting.
12	So we'll just keep in touch with you through
13	John, and think about when is the next opportune time
14	to schedule our next subcommittee meeting.
15	And with that, unless there's no other
16	comments or questions, thanks again to everyone, and we
17	are adjourned.
18	(Whereupon, the above-entitled matter went
19	off the record at 5:05 p.m.)
20	
21	
22	
23	
24	
25	

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# Overview of RISC Working Group Efforts on Treatment of Uncertainty in Decisionmaking using Probabilistic Risk Assessments

Sunil Weerakkody Chief, PRA Operations and Human Factors Branch Office of Nuclear Reactor Regulation U.S. NUCLEAR REGULATORY COMMISSION

#### ACRS Subcommittee Meeting May 5, 2015



Protecting People and the Environment

# **Background on RISC**



- NRC RISC and NEI RISC are steering committees comprised of counterpart senior management from NRC, NEI.
- NRC RISC was formed in October 2013 to advance the use of risk-informed decisionmaking (RIDM) in licensing, oversight, rulemaking and other regulatory areas.

# **Objectives of the RISC**



- Establish strategic direction of NRC staff activities
- Develop and communicating an internal vision for future regulatory use of Probabilistic Risk Assessment (PRA)
- Provide guidance to the NRC staff consistent with the Commission's PRA Policy Statement
- Engage external stakeholders on the use of PRA, listen to concerns and communicate NRC actions
- Discuss initiatives that can be taken by the NRC to incentivize continued development of PRAs
- To discuss industry actions necessary to achieve the vision for future use of PRA to support regulatory decisions

# **RISC Working Groups**



• Two Working Groups:

- WG#1: PRA Technical Adequacy of Methods
- WG#2: Treatment of Uncertainty in Risk-Informed Decision Making

# Overview of RISC Working Group Efforts on Treatment of Uncertainty in Decisionmaking using Probabilistic Risk Assessments

### Fernando Ferrante Office of Nuclear Reactor Regulation U.S. NUCLEAR REGULATORY COMMISSION

#### ACRS Subcommittee Meeting May 5, 2015



Protecting People and the Environment





- Scope of Working Groups (WGs) on Treatment of Uncertainty in Decision-making
- Discussion of WG activities, insights gained
- Presentation of recommendations, path forward

# **RISC WG on Uncertainty**



- RISCs agreed on specific topics to address via counterpart NRC and NEI WGs that include technical staff working on specific subjects impacted by RIDM
- NRC and NEI WGs were created to address treatment of uncertainty in RIDM with specific objectives:
  - Identify the specific causes for not being able to address uncertainties in current risk-informed applications in an efficient or effective manner
  - 2. Evaluate current approaches to addressing uncertainties in riskinformed decision-making and identify any gaps that need to be resolved
  - 3. Propose enhancements to the existing framework for addressing practical aspects of the treatment of uncertainty in risk-informed decision-making
  - Identify potential education mechanisms for both PRA practitioners and broader audiences, with respect to the treatment of uncertainty in decision-making

# **Specific Causes**



#### Foundational aspects

- Inconsistencies in the treatment of uncertainty
- Model uncertainty and completeness issues
- Guidance and "culture gaps"

#### Implementation aspects

- "Aggregation" (summation of hazard contributors)
- Understandable process for dealing with irreducible uncertainties
- How to deal with varying levels of confidence in the mean estimates for specific hazards
- Communicating importance of uncertainty to decisionmakers at different levels

# **Current Approaches**



- Review of NRC guidance and available documents
  - NRC Regulatory Guide 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis"
  - NRC Inspection Manual Chapters (IMCs) (e.g., IMC 0609)
  - NUREG-1855, "Guidance on the Treatment of Uncertainties Associated with PRAs in Risk-Informed Decision Making"
  - EPRI 1016737, "Treatment of Parameter and Model Uncertainty for Probabilistic Risk Assessments"
  - EPRI 1026511, "Practical Guidance on the Use of PRA in Risk-Informed Submittals with a Focus on the Treatment of Uncertainties"
  - NRC Office Instruction LIC-504, revision 3, "Integrated Risk-Informed Decision-Making Process for Emergent Issues"
- Brief discussion of other sources of information

# **RISC WG Workshop**



- Public meeting on November 20, 2014, in a tabletop workshop format
- Purpose of Workshop:
  - Identify gaps and/or enhancements to guidance in order to improve the communication and handling of uncertainties in risk-informed decisions
- Workshop used a series of hypothetical examples to examine how well existing NRC and industry guidance addresses uncertainties
- Significant discussion took place, summary provides detailed insights and recommendations



0. Nominal case: all values below acceptance guidelines

- 1. Baseline values below acceptance guidelines
- 1A Parametric uncertainty spans above
- 1B Sensitivity studies below/above guideline
- 1C Risk profile incomplete
- 1D Mean value not well characterized
- 1E Conservative treatment masks Δrisk impact
- 2. Baseline values above acceptance guideline
  - 2A Mean exceeds acceptance guideline
  - 2B Evidence of a conservatism-driven result

# NUREG-1855 Fig. 9-1



### **NUREG-1855** Comparison Regimes



Figure 9-1 Relationship of the comparison regimes to the acceptance guidelines

### **Workshop Insights**





### Recommendations



- The NEI WG conveyed the set of recommendations via a White Paper (ML15062A118).
- The NRC WG reviewed the NEI WG White Paper, to evaluate the recommendations, and to provide the NRC WG's suggested path forward to the NRC RISC on these recommendations.
- The NRC WG has agrees with the recommendations in the NEI White Paper but also provided additional comments on the context and characterization of issues identified
- The NRC WG submitted memorandum to provide information to NRC RISC in order to make decisions on implementation/prioritization of recommendations



The NEI White Paper provides the following recommendations:

- 1. Clarify Expectations for the Treatment of Uncertainty
- 2. Provide Guidance on Risk Aggregation
- 3. Develop Guidance on Integrating PRA Results into a Decisionmaking Framework
- 4. Develop Additional Guidance on Addressing Specific Challenges
- 5. Provide Guidance on Addressing Mitigating Strategies in RIDM
- 6. Conduct Annual Industry-NRC meetings on RIDM
- 7. Provide Education for Practitioners on Current Guidance
- 8. Provide a Training Course on RIDM and the Role of Uncertainty



#### Clarify Expectations for the Treatment of Uncertainty

- Significant new revisions have been made to NUREG-1855 providing a vehicle for practical guidance development and dissemination through other risk-informed guidance
- The NRC WG recommends performing a "pilot" of NUREG-1855, Revision 1, using one or more examples of riskinformed decisions shortly after issuance of Revision 1 (less formal pilot of an actual application, but more than a tabletop)
- Based on the NUREG-1855, Revision 1, "pilot," consider how additional enhancements and modifications should be included in a future revision of NUREG-1855.



#### Provide Guidance on Risk Aggregation

- Subject of "Risk Aggregation" (i.e., the consideration of multiple hazards and their aggregated results within PRA) was brought up in multiple discussions
- Main focus of discussions was on risk-informed actions given different levels of treatment of uncertainty, other aspects go into regulatory, policy issues
- The NRC WG recommends that the NRC RISC consider additional activities in this area, including research activities in the technical aspects as well as additional NRC and Industry WGs to evaluate the regulatory issues.



#### Develop Guidance on Integrating PRA Results into RIDM

- The NEI White Paper includes a recommendation to integrate the PRA results in RIDM across multiple applications
- The NRC WG staff agrees that consistency in the treatment of uncertainty is important, albeit specific applications (e.g., licensing, oversight) would still require separate guidance
- The NRC WG, therefore, recommends that the NRC RISC consider providing direction to the individual process owners of the various NRC guidance documents and that relate to the treatment of uncertainty in RIDM to coordinate their activities



#### **Develop Additional Guidance on Addressing Specific Challenges**

- One important topic addressed during NRC and NEI WG discussions involved RIDM when faced with very large, irreducible uncertainties (e.g., external hazards)
- The NRC WG recommends that the NRC RISC support efforts to enhance current guidance based on the output of specific research activities
  - External flooding (via Probabilistic Flood Hazard Assessment Research Plan)
  - Seismically-induced fires, floods (via SRM SECY 11-0137)
  - High wind assessments
  - Others



#### Provide Guidance on Addressing Mitigating Strategies in RIDM

- The topic of Mitigating Strategies in RIDM was raised as a correlated subject to the treatment of uncertainty
- The NRC and NEI WGs, it is recognized that analysis uncertainties may play a significant role in crediting plantspecific mitigating strategies in PRAs; but issue has wider implications as well as on-going efforts
- The NRC WG suggests that an effort be initiated to address the treatment of mitigating strategies within PRA. Additional technical coordination beyond this WG is recommended





#### Conduct Annual Industry-NRC meetings on RIDM

- One of the NEI recommendations includes consideration of an annual Industry-NRC meeting on RIDM
- The NRC WG agrees with this recommendation and recommends the initiation of interactions with Industry on how to organize this activity

#### Provide Education for Practitioners on Current Guidance

 The NRC WG recommends that NRC and Industry evaluate the need for a joint NRC-Industry workshop on NUREG-1855, Revision 1, to help practitioners understand the expectations if the guidance and other relevant documents

### **Recommendation 8**



#### Provide a Training Course on Risk-informed Decision-making and the Role of Uncertainty

- Initial review by the NRC WG indicates that significant training exists, however, it is usually geared towards (1) detailed technical information for risk practitioners, or (2) a brief overview of PRA concepts for non-practitioners
- In these areas, the NRC WG recommends: •
  - Evaluation of current training and communication tools with respect to treatment of uncertainty in RIDM
  - If the recommended evaluation reveals current training and communication tools are inadequate, then, additional internal NRC actions could be developed and implemented based on the guidance stemming from NUREG-1855, Revision 1
  - Joint training with Industry may also be developed, similar to the ongoing periodic EPRI-NRC Fire PRA training

# **Additional NRC comments**



- Challenges in treatment of uncertainty should not be a deterrent to make sound risk-informed decisions
  - if a hazard or issue is potentially significant to a risk-informed decision, then it should be addressed in a PRA following the existing guidance that is used for risk-informed regulatory actions
- The NRC WG believes the more significant challenge for treatment of uncertainty in external events is the presence of irreducible uncertainties in the hazard itself, as opposed to perceived biases or lack of maturity
- The appropriate balance between absolute and relative insights should be presented to the decisionmakers to:
  - (1) avoid the implication that all PRA assumptions are conservative a priori, focus on risk-insights
  - (2) avoid perception of overconservatism by placing too much emphasis on relative insights (e.g., presence of one dominant contributor in a risk profile does not mean others can be ignored) 19

## Conclusions



- NRC and NEI WGs participated in activities to identify specific challenges, gaps, and enhancements needed in the treatment of uncertainty in decision-making
- NRC WG agrees with recommendations in the NEI WG White Paper and has submitted a memo to the NRC RISC
- NRC WG expects NRC RISC to deliberate and decide on approval and allocation of resources/ownership for individual actions associated with the recommendations
- The NRC WG recommends that the NRC RISC consider the activities of this WG complete and transfer the proposed recommendations to the appropriate NRC program offices

# Current Status on Guidance on Treatment of Uncertainty in Risk-Informed Decisionmaking (NUREG-1855)

### Mary Drouin Office of Nuclear Regulatory Research U.S. NUCLEAR REGULATORY COMMISSION

ACRS Subcommittee Meeting May 5, 2015



Protecting People and the Environment



# **Objectives – NUREG-1855**

- Provides guidance on how to treat uncertainties associated with PRAs used by a licensee or applicant to support a risk-informed application to NRC.
- Specifically, guidance is provided with regard to:
  - Identifying and characterizing the uncertainties associated with PRA
  - Performing uncertainty analyses to understand the impact of the uncertainties on the results of the PRA
  - Factoring the results of the uncertainty analyses into the decisionmaking 2

Current Status of Revision 1 (1 of 2)



- Publicly available in ADAMS: ML15026A512
- Revision 1 better structures the guidance to licensees and further clarifies the NRC staff decisionmaking process in addressing uncertainties:
  - Applicability of the NUREG
  - Scope and level of detail necessary to support the application
  - Address the missing scope and level-of-detail
  - Parameter and model uncertainty impact on the acceptance guidelines

# Current Status of Revision 1 (2 of 2)



- Revision 1 changes (cont'd)
  - Adequate justification to support the application
    - Redefining the application
    - Refining the PRA
    - Using compensatory measure or performance monitoring
  - Staff process for determining acceptability
    - Is the scope and level of detail of the PRA appropriate for the application?
    - Is the PRA model technically adequate?
    - How do the risk results compare to the acceptance guidelines?
    - How do parameter and model uncertainties impact the risk results?
    - Is the acceptability of the application adequately justified?



### Path Forward

- Intend to hold public workshop on Revision 1 of NUREG-1855
  - Workshop to be co-sponsored with EPRI
  - Workshop planned for the fall 2015
- Considering developing training course on risk-informed decisionmaking with guidance on treatment of uncertainties

# Addressing Uncertainty: The Hobgoblin of Risk-informed Decision-making

Presented to: ACRS PRA Subcommittee

Presented by:

Doug True

ERIN Engineering & Research, Inc.

May 5, 2015

# Uncertainty in Risk-informed Decision-making

- Industry Working Group
- A Decision-maker's Dilemma
- Treatment of Uncertainties
- Aggregation of Risk Results
- Interpretation of Risk Results
- Truly Integrated Decision-making

# WG2 Recommendations

<u>Clarify Guidance</u>

- Clarify expectations for treatment of uncertainty
- Provide guidance on risk aggregation
- **Enhancing Decision-making Process**
- Develop guidance on integrating PRA results into a decision-making framework
- Develop additional guidance on addressing specific challenges

#### **Mitigating Strategies**

Provide guidance on addressing mitigating strategies in risk informed decision making

**Education** 

- Conduct annual industry-NRC meetings on risk informed decision making
- Provide education for practitioners on current guidance

There is an impending need to address these recommendations given the on-going post-Fukushima activities
### Document Map – Treatment of Uncertainty



# Industry WG2 Proposed Action Plan Outline



 KEY

 NRC Activities
 Industry Activities

### A Decision-maker's Dilemma



# Uncertainty Implications in Risk-informed Decision-making

- PRA results are the product of a model that contains uncertainties and biases
- RG 1.174 outlines an integrated decision-making framework, in part to address uncertainties in PRA results
  - PRA is one input
  - Too often, the elements are treated separately
- Some key issues:
  - Treatment of uncertainties
  - Aggregation of risk results
  - Interpretation of risk results
  - Truly integrated decision-making

# Aggregation

- Summation of mean values is a natural outcome of a PRA
- The sum should not be viewed as anything more than a relative indicator
  - Insights come from the disaggregation of the results into scenarios
- Use of top-level risk criteria as strict limits ignores:
  - Uncertainties differ across contributors
  - Contributors with differing levels of realism
  - Inherent margins in quantitative acceptance guidelines
  - The valuable information underlying the PRA result

### Surrogate Risk Acceptance Guidelines

- Quantitative Health Objectives (QHOs) establish NRC policy on acceptable risk
- Surrogate risk acceptance guidelines have been developed for use in risk-informed applications:

- Early fatality QHO  $\rightarrow$  total mean LERF < 1x10<sup>-5</sup>/yr

- Latent cancer QHO  $\rightarrow$  total mean CDF < 1x10<sup>-4</sup>/yr
- NUREG-1860 demonstrated on a bounding basis (NUREG-1150 maximums) that these guidelines are appropriate
- Many advances in severe accident research since NUREG-1150

### **Risks At Subsidiary Objectives**



# Insights on Surrogate Guidelines

 Both more representative average results and more recent SOARCA results indicate that significant margin exists between subsidiary guidelines for CDF/LERF and the QHOs

- Factor of 100 margin (or more) based on SOARCA

- This margin should allow:
  - Mean values to be used with confidence in riskinformed decision-making
  - No need for knife-edged treatment, treat as "guidelines", not limits
  - Uncertainties should not impede decision-making

Addressing Model Uncertainties: Sensitivity Analyses for CPRR

- Plant-to-plant variability
- Risk model uncertainties
- Severe accident phenomenological uncertainties
- Consequence model assumptions

14 different sensitivity areas, involving over 150 separate sensitivity results

### RG 1.174 "Integrated" Risk-informed Decision-making Process



# Integrating the Decision

- The whole idea of an "integrated" process is bring them together to treat as a whole
   Not a linear series of gates
- This process should allow us to deal with the uncertainties, strengths, and limitations of PRA while making good safety decisions
- Requires decision-makers be provided with all of the elements, including the implications of uncertainties

## A Possible Risk-informed Rubric

### Purpose

Characterize the overall risk from plant operations with respect to the subsidiary safety of objective of CDF<1x10<sup>4</sup>/yr.

### **Risk Information**



Parametric Uncertainty • Mean values represented in results <u>Modeling Uncertainty</u> • Fire PRA methods result in a substantial overstatement of fire CDF. Important contributors associated with fires not observed in US OPEX. Completeness Uncertainty

### All relevant site hazards and operating modes considered except: High winds – design basis shown to protect to 1E-7/yr

Overall Risk Characterization

- Computed total CDF exceeds subsidiary objective by ~10%
- Non-realistic fire PRA methods are primary cause of this computed exceedance. However, realistic fire
  methods are not available at this time.

### Defense-in-Depth Characterization

- No DID vulnerabilities identified
- · All fire scenarios confirmed to have at least one success path

### Safety Margin Characterization

No vulnerabilities identified

### Performance Monitoring

Annual average CDF monitoring performed as part of Maintenance Rule

Routine PRA updates scheduled for every 4 years

### Integrated Decision-making Inputs

	•		
Risk	Defense-in-Depth	Safety Margins	Performance Monitoring
Conservatism-driven Exceedence	Confirmed	Confirmed	Annual Average CDF Monitoring

Conclusion:

- Although the computed total CDF exceeds subsidiary objective by ~10%, no specific weaknesses in the plant design were identified.
- Exceedence driven by non-realistic fire PRA methods.

- EPRI has conceived a standard risk-informed rubric for decision-makers
- Builds upon principles described in other guidance
- Address both the risk information and the other elements of the riskinformed decision
- Published EPRI 3002003116

# A Possible Risk-informed Rubric

Purpose Characteri	Risk I	nformation			
CDF<1x10 Risk Infor	1.2E-04	/yr		Parametric Uncertainty	e of
1.0E-04/yr Su	1.0E-04	Ar Subsidiary Objective	REALISTIC HIGH BOUNDING VERY HIGH		
8.0E-05Ayr			CONSERVATIVE HIGH	Modeling Uncertainty	5
Contrained a 1 0 0000000000000000000000000000000000	8.0E-05 <b>E CD</b> g	/yr	REALISTIC HIGH	substantial overstatement of fire CDF. Important contributors	
2.05-05/yr	00 00 05 01 00 00 01 00	<sup>/yr</sup> External Flooding		associated with fires not observed in US OPEX.	
0.0E+00/yr	4 0F-05	■Seismic	CONSERVATIVE MODERATE		
Comput     Non-rea method     Defense-     No DID     All fire s	Defen • No E • All fi	se-in-Depth Characterization DID vulnerabilities identified rescenarios confirmed to have Integrated Decision-making	at least one success nat	A starting point for moving to a more	
Safety Ma <ul> <li>No vuln</li> </ul> Performa	• No	Risk	Defense-in-Depth	making process	
<ul> <li>Annual</li> <li>Routine</li> </ul>	Perfo	Conservatism-driven Exceedence	Confirmed	CDF Monito	age pring
Cons Ex Conclusion • Although plant des	All     Rol     ceedence     the computision were id	<ul> <li><u>Conclusion</u>:</li> <li>Although the computed total plant design were identified.</li> <li>Exceedence driven by non-r</li> </ul>	CDF exceeds subsidiary ol realistic fire PRA methods.	ojective by ~10%, no specific weaknesses	s in the

# Summary

- Uncertainties must be honestly understood and characterized for risk-informed decision-makers
- No need to treat acceptance guidelines as hard risk limits
- A truly integrated decision-making process is needed to gain the value from risk-informed applications
- Progress being made, but still work to do

The promise of risk-informed regulatory decision-making lies in the objective and integrated insights that can be gained

### **BACKUP SLIDES**

### **Baseline CPRR Results**



### **CPRR Sensitivities**

Sensitivity Parameter	Approach	Alternatives	Metrics	Conclusions
Plant to Plant Variability				
Containment Heat Capacity	Qualitative	N/A	N/A	<ul> <li>Reference plant has most limiting containment heat capacity of US fleet</li> </ul>
Torus Freeboard Volume	Qualitative	N/A	N/A	Reference plant is one of the most limiting with respect to torus freeboard volume.
				• Ample time exists for operating staff and emergency response organization to implement SAWM.
DW to WW Spillover Height	Qualitative	N/A	N/A	<ul> <li>Water addition is the most significant factor in providing debris cooling and controlling drywell temperatures.</li> </ul>
Population	Qualitative	2A	0-10 mi	<ul> <li>Reference plant represents the second largest population site. Sensitivity to address largest population site reveals no significant impact.</li> </ul>

## **CPRR Sensitivities (Cont.)**

Sensitivity Parameter	Approach	Alternatives	Metrics	Conclusions
Probabilistic Logic Mode	)	-	-	
ELAP frequency	Qualitative	Base, 2A, 3A, 5B	LCF, MACR, ΔMACR	<ul> <li>Risk results vary linearly with the assumed ELAP frequency.</li> </ul>
				• The maximum credible change is on the order of a factor of 3, given that there is no evidence that ELAP core damage frequencies are greater than the CDF quantitative objective of 1E-4/yr.
Human error rates for severe accident water addition	Quantitative	2A	LCF, MACR, ∆MACR	<ul> <li>Risk results are not highly sensitive to the human error probabilities assumed over a broad range of probabilities</li> </ul>

## **CPRR Sensitivities (Cont.)**

Sensitivity Parameter	Approach	Alternatives	Metrics	Conclusions
Phenomenological				
SRV Seizure During Core Melt	Quantitative	Base, 2A, 3A, 5B	LCF, MACR, ΔMACR	• The baseline SRV seizure assumptions from SORCA reduce the overall risks by ~20% versus a case where no SRV seizure occurs for all cases except the filtered case (Alternative 5B), where no change was observed.
In-Vessel Retention	Quantitative	Base, 2A, 3A, 5B	LCF, MACR, ΔMACR	• Assuming that water addition during the core melt process does not prevent vessel breach results in a small increase in risks from Alternative 2A.
LMT Timing	Qualitative	N/A	Cesium Release	• Due to revaporization of deposited radionuclides, delay in LMT does not show a significant impact on source term.

### SRV Seizure Sensitivity Results



Ref. - EPRI 3002003301

# **CPRR Sensitivities (Cont.)**

Sensitivity Parameter	Approach	Alternatives	Metrics	Conclusions
Benefit Model				
Deposition Rate	Quantitative	Base, 2A, 3A, 5B	LCF, MACR, ΔMACR	• Adopting the aerosol deposition rate from NUREG-1150 increases the economic risk in the Base Case by over 20%, but has only a very small impact (<10%) on the alternatives that provide severe accident water addition.
Evacuation Effectiveness	Quantitative	Base, 2A, 3A, 5B	LCF, MACR, ΔMACR	<ul> <li>Computed risks are relatively insensitive to evacuation effectiveness from 95% to 100%.</li> </ul>
				• Cases with no evacuation showed much higher latent cancer risks than cases with relatively effective evacuation, but negligible impact on overall financial risks.
\$/Person-rem	Quantitative	Base, 2A, 3A, 5B	MACR, ΔMACR	<ul> <li>Changing the value of a person- rem from \$2,000 to \$5,200 increases the overall financial consequences. However, this change only translates to a ~30% increase in the financial risks.</li> </ul>

## **CPRR Sensitivities (Cont.)**

Sensitivity Parameter	Approach	Alternatives	Metrics	Conclusions
Benefit Model (Cont.)				
Discount Rate	Quantitative	Base, 2A, 3A, 5B	MACR, ΔMACR	• A bounding assumption of no discount on the present value of property (i.e., no property depreciation) increased the overall financial results by approximately a factor of 2.
Combination – Discount Rate & \$/Person-rem	Quantitative	Base, 2A, 3A, 5B	MACR, ΔMACR	• The combined impact of a lower discount rate (3%) and a higher value of a person-rem (\$5,200) increases the overall financial risks by approximately a factor of 2.