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

June 3, 2016

MEMORANDUM TO: ACRS Members

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

SUBJECT: CERTIFICATION OF THE MINUTES OF THE ACRS METALLURGY AND REACTORS FUELS SUBCOMMITTEE ON MARCH 22, 2016

The minutes for the subject meeting were certified on June 1, 2016. Along with the transcripts and presentation materials, this is the official record of the proceedings of that meeting. A copy of the certified minutes is attached.

Attachment: As stated

cc with Attachment: A. Valentine
M. Banks

UNITED STATES
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WASHINGTON, DC 20555 - 0001

MEMORANDUM TO: Maitri Banerjee, Senior Staff Engineer
Technical Support Branch
Advisory Committee on Reactor Safeguards

FROM: Ronald Ballinger, Chairman
Metallurgy & Reactor Fuel Subcommittee
Advisory Committee on Reactor Safeguards

SUBJECT: CERTIFIED MINUTES OF THE ACRS METALLURGY AND REACTOR FUELS SUBCOMMITTEE MEETING ON MARCH 22, 2016

I hereby certify, to the best of my knowledge and belief, that the minutes of the subject meeting on March 22, 2016, are an accurate record of the proceedings for that meeting.

/RA/ **June 1, 2016**

Ronald Ballinger, Chairman
Metallurgy & Reactor Fuel
Subcommittee

Dated

Certified on: June 1, 2016
Certified by: Ronald Ballinger

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
MINUTES OF THE METALLURGY & REACTOR FUELS SUBCOMMITTEE
MEETING ON RG 1.229
MARCH 22, 2016, ROCKVILLE, MD

The ACRS Metallurgy & Reactor Fuels Subcommittee held a meeting on March 22, 2016 in T2B1, 11545 Rockville Pike, Rockville, Maryland. The meeting convened at 8:30 a.m. and adjourned at 11:24 a.m.

The meeting was open to the public.

No written comments or requests for time to make oral statements were received from members of the public related to this meeting.

ATTENDEES

ACRS Members/Staff

R. Ballinger, Chairman
D. Bley, Member
J. Rempe, member
D. Skillman, Member
D. Powers, Member
M. Corradini, Member*
J. Stetkar, Member
M. Banerjee, ACRS Staff (DFO)

NRC Staff and Consultants

C.J. Fong, NRR	Steven Lauer, NRR
Joseph Giitter, NRR	Stephen Smith, NRR
Jessica Kratchman, NRR	Mary Drouin, RES
Donald Harrison, NRO	Justin Fuller, OCM
Ashley Smith, NRR	Antonio Gomez, NRR
Bob Hardies, NRR	Rob Tregoning, RES
Mehdi Reisi-Fard, NRR	

Other Attendees

Larry Naron, Exelon	Wayne Harrison, STPNOC
Stephen Geier, NEI	Steven Blossom, STP
Ernie Key, Public Participant*	Phil Grissom, SNC

*Connected via telephone

SUMMARY

The purpose of the meeting was to review the draft Regulatory Guide 1.229, "Risk-Informed Approach for Addressing the Effects of Debris on Post-Accident Long-term Core Cooling" (RG 1.229). The meeting transcripts are attached and contain a description of each matter discussed during the meeting. The presentation slides and handouts used during the meeting are attached to these transcripts.

The following list describes significant issues discussed during the meeting with the corresponding pages in the transcript referenced.

SIGNIFICANT ISSUES	
Issue	Reference Pages in Transcript
Chairman Ballinger started the meeting introducing the ACRS members present. After noting that the purpose of the meeting was to discuss RG 1.229 and prior ACRS briefings on the subject, he invited Joe Giitter, NRR, to introduce the staff presenters and start the briefing.	4-5
Mr. Giitter noted that more realistic methods, which appeared in an earlier version of the draft RG were not included in the current version due to ongoing work on resolving issues with the more realistic approach. The work is expected to be completed by the end of the year. In the meantime, the current version of the RG, based on tried-and-true methods that have been demonstrated to be effective in applications, will be available for use. Member Powers asked the staff to elaborate of the words "demonstrated to be effective," given that demonstration under realistic conditions was not a part of the current version of the RG. A long discussion followed. The staff mentioned the pilot program and that RG 1.229 builds upon the existing RGs.	5-10
Member Rempe asked about the treatment of the containment accident pressure in the RG. The staff noted that RG 1.82 would continue to apply	10-11

unless a plant has an exception that authorized credit for containment accident pressure in their licensing basis.	
To define the scope of staff presentation, Mr. Fong noted that they would highlight the differences between the RG that was discussed on November 4th of last year and the RG as it stands today. With an example of minor changes, Mr. Fong went into the discussion of substantial changes made to Appendix C of the RG. The bounding method for partitioning of LOCA frequencies was kept and the other two methods, a conservative partitioning method and a semi-quantitative partitioning method (increasingly realistic), were deleted. The bounding tends to produce the highest delta CDF. The staff continues to work on the other two methods. The members questioned the basis of staff's characterization of the final method remaining in the RG as "a little bit on the conservative side," given their experience with the pilot plant (STP) of somewhat unique design (may not be representing the fleet). The staff discussed an example of comments that made them exclude the other two methods. The staff expects to augment the RG with additional methods by the end of the year.	11-19
Discussion on the RG readiness for issuance and need for such issuance took place. The staff pointed out that 13- 14 non-pilots plan to use the bounding approach in the RG.	19-22
Mr. Fong presented the difference between the detailed approach for risk assessment of debris in Appendix A and the simplified approach in Appendix B. The App. A correlation of time versus head loss to drive the probability of these new basic events has been replaced in App. B with a conditional core damage probability of zero if the calculated debris falls below a threshold value. Upon member Stetkar's question a long discussion broke out on how uncertainties are handled in App. B, particularly the uncertainties related to the deterministic parameters involved and experiments done to validate. The staff's position was that conservativeness that comes with the use of RG1.82 would account for these uncertainties.	23-28
Staff presented their conclusions. Whether to change the base PRA to include those scenarios that are assigned to core damage (i.e., CCDF or CLRF of 1.0 in App. B) was asked by member Stetkar.	29-35
Member Powers asked if staff considered possible strategies to address uncertainties related to not knowing the unknowns. He noted the impact of radiation field to chemistry, although, its effect may be small. In response, staff mentioned the conservatism built into the process. Member Powers noted that risk-informed approach is the only way to address these kinds of concerns, and why a defense-in-depth strategy may not always address it.	35-41

Expanding upon member Stetkar's question on the need to change the base PRA, member Skillman asked if following RG 1.229 approach for a license amendment would land the licensee in configuration control challenges, among others. The staff stated that they did not intend the RG to address that; however, they would take a look at that question.	41-48
Member Stetkar noted that combinations of systems/trains assumed to operate would affect debris transport to screens, and hence the risk number. A long discussion took place on modifying the PRA to reflect the risk analysis done under App. A and App. B. Member Stetkar repeated his concern on lack of guidance in App. B regarding need to update the PRA with scenarios considered.	48-61
Chairman Ballinger had a question from member Corradini listening on the phone line regarding the BWR licensees' use of the RG. The staff noted that without a pilot it was difficult to address the issue for non-PWR plants and that they had not heard of a BWR licensee that wanted to use the RG approach.	61-66
Member Bley noted that the RG, specifically App. B, could benefit from addition of clarifications in the areas discussed above to prevent unnecessary RAIs from the staff reviewers.	66-67
Member Stetkar questioned the uncertainty in the threshold value in App. B, what he called "pass-fail" approach. He noted that parametric uncertainty within a consensus model needed to be considered to comply with the guidance in NUREG-1855. He cited amounts and types of debris, transport and deposition of the debris, and the effects of chemicals and particulates and fibers in that debris as examples. He noted that consideration of uncertainties in the risk-informed process can address concerns about the unknown unknowns. The staff pointed to the safety margins existing in the process and considered the approach to be reasonable.	67-75
A long discussion occurred upon member Stetkar's question about non-LOCA transients generating debris, and if the RG addressed that adequately including frequency screening. Discussion included effects of a seismic event outside a seismic-induced pipe break. The staff agreed to review the RG for need for additional clarity.	76-89
In his introductory remarks Steve Geier, NEI noted the need for efficient implementation of the RG without expenditure for substantial resources. Mr. Larry Naron, Exelon, delivered the industry presentation, and was asked by member Rempe to provide a BWR perspective. He noted the narrow (PWR only) scope of the RG, and had a few recommendations for improvements in areas that according to him may require significant interaction between the licensee and NRC staff to resolve (e.g., low	90-98

frequency LOCAs, periodic update, very qualitative threshold for reporting, introduction of cumulative conservatism by deterministic inputs). Regarding the last issue, Mr. Naron said that trying to refine the deterministic inputs would be cost-intensive.	
Mr. Harrison, STPNOC, provided an account of how the pilot plant started with the detailed approach and ended up with the simplified one. Their objective, as in the RG was to close the Generic Letter 2004-02. They do not consider this as a PRA calculation, but will add the process, model, and the assumptions that went into this evaluation into their updated final safety analysis report to reflect the licensing basis.	98-100
Member Skillman initiated a discussion on the reporting requirement. Mr. Harrison noted the qualitative criteria related to the reduction in defense in depth or safety margin were difficult to apply. However, the plants that are using the guidance found the RG to be overall useful and acceptable. Mr. Harrison expected dialogue similar to the ones between the ACRS members and the staff to happen between the licensee and the staff in the implementation of the RG.	100-105
Member Corradini asked for industry view on staff's plan to issue the RG with impending work on App. C on two additional methods. It was reported that there were some other plants following on that need to refer to the RG. Mr. Geier noted that it would be worthwhile to put the RG out on the street now, and have the remaining addition to follow later this year.	106-108
Chairman Ballinger asked for public comments. Mr. Ernie Key on the telephone line provided additional comments on the use of initiating events in the process vs. basic events in the PRA, uncertainty quantification, and inclusion of the risk assessment in the PRA. He noted that even with a simplified approach the magnitude of the risk was on the order or 10^{-7}. In the more detailed approach it was even lower, ~ 10^{-8}. Hence, with a typical PRA CDF of 10^{-5}, this was very, very small. Steve Blossom from South Texas noted that Mr. Kay was representing the industry.	108-111
Chairman Ballinger asked for comments from members. Noting the limited scope of the RG, i.e., the incremental risk from a break at a certain location causing debris, member Skillman asked the staff to expand upon the extent of applicability during the full committee presentation. Member Bley noted that the RG was cleaned up a lot since the subcommittee members reviewed it back in December. And also that the lack of specificity in the RG appendices would make staff's review process tougher. As staff worked on the alternative methods for Appendix C, he wanted them to revisit discussions members had back in December. Member Stetkar summarize his three major points:	111-117

1) lack of clarity in terms of the expected scope of the assessments which would be performed 2) the expectation for how the PRA or the information in the PRA be used to support the simplified analysis in Appendix B, and should that evaluation then become part of the PRA going forward as an assessment of the risk from debris 3) how uncertainty is treated beyond that for LOCA frequency, i.e., in the so-called deterministic consensus methods Member Rempe encouraged the staff to add clarifications as they noted in discussions during the meeting. Also, if industry thinks it might help and the staff agrees, then they should issue the RG. Member Corradini mentioned the need for issuing the RG before completing the work on Appendix C. Regarding completeness, he reiterated member Power's question on (changes in) chemistry effects induced by radiation.	
A short deliberation took place regarding the need for a full committee meeting and an ACRS letter on RG 1.229. The staff agreed regarding need for an ACRS letter. Member Bley noted that at the FC meeting the staff can explain the timeliness of issuing the RG. Member Powers noted that use by additional licensees could guide the completion of the RG. The staff pointed out that several licensees are in the queue to use this (RG) method, and the staff expects to review several of the applications in calendar year 2016. Additionally, Commission's expectation, following the policy on the cumulative effects of regulation, guides the staff to release the RG for public use when the rule (50.46c) goes out.	118-120
Chairman Ballinger adjourned the meeting at 11:24 a.m.	121

Documents provided to the Subcommittee

1. Draft Regulatory Guide 1.229 (draft was issued as DG-1322, dated April 2015), "Risk-informed Approach for Addressing the Effects of Debris on Post-Accident Long-term Core Cooling" (ADAMS Accession No. ML16062A016)
2. NRC resolution of public comments on RG (ML16062A016, ML16062A014)
3. Compare between RG 1.229, December 2015 and RG 1.229 March 2016 (after incorporation of public comments - ML16062A015)
4. Preliminary Draft Regulatory Guide 1.229, "Risk-Informed Approach for Addressing the Effects of Debris on Post-Accident Long-term Core Cooling," October 19, 2015 (ML15292A012)
5. Preliminary Draft – "DRAFT Appendix C – Partitioning Plant-Wide LOCA Frequency," October 19, 2015 (ML15292A010)
6. NRC, "Staff Requirements – SECY-12-0093 – Closure Options for Generic Safety Issue 191, Assessment of Debris Accumulation on Pressurized-Water Reactor Sump

Performance." Washington, DC, December, 14, 2012 (ML12349A378).
7. NRC, "Staff Requirements – SECY-12-0034 – Proposed Rulemaking - 10 CFR 50.46c: Emergency Core Cooling System Performance during Loss-of-Coolant Accidents (RIN 3150-AH42)." Washington, DC, January, 7, 2013 (ML13007A478).
8. ACRS letter "Draft Final Rule to Risk-Inform 10 CFR 50.46, 'Acceptance Criteria for Emergency Core Cooling Systems for Light-Water Nuclear Power Reactors'," November 16, 2006 (ML063190465)
9. Regulatory Guide (RG) 1.174, Rev. 2, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," May 2011 (ML100910006)
10. RG 1.82, Rev. 4, "Water Sources for Long-Term Recirculation Cooling Following a Loss-of-Coolant Accident," March 2012 (ML111330278)

Official Transcript of Proceedings

NUCLEAR REGULATORY COMMISSION

Title: Advisory Committee on Reactor Safeguards
Metallurgy and Reactor Fuels Subcommittee

Docket Number: (n/a)

Location: Rockville, Maryland

Date: Tuesday, March 22, 2016

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS (ACRS)

+ + + + +

METALLURGY AND REACTOR FUELS SUBCOMMITTEE

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TUESDAY

MARCH 22, 2016

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ROCKVILLE, MARYLAND

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The Subcommittee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B1, 11545 Rockville Pike, at 8:31 a.m., Ronald G. Ballinger, Chairman, presiding.

COMMITTEE MEMBERS:

RONALD G. BALLINGER, Chairman

DENNIS C. BLEY, Member

MICHAEL CORRADINI, Member*

DANA A. POWERS, Member

JOY REMPE, Member

GORDON R. SKILLMAN, Member

JOHN W. STETKAR, Member

DESIGNATED FEDERAL OFFICIAL:

MAITRI BANERJEE

ALSO PRESENT:

STEVEN BLOSSOM, STP

C.J. FONG, NRR

STEPHEN GEIER, NEI

JOSEPH GIITTER, NRR

DONALD HARRISON, NRO

WAYNE HARRISON, STPNOC

ERNIE KEY, Public Participant*

JESSICA KRATCHMAN, NRR

STEVEN LAUER, NRR

LARRY NARON, Exelon

STEPHEN SMITH, NRR

*Present via telephone

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P R O C E E D I N G S

8:31 a.m.

CHAIRMAN BALLINGER: This is a meeting of the Metallurgy and Reactor Fuels Subcommittee of the Advisory Committee on Reactor Safeguards. I'm Ron Ballinger, Chairman of the Metallurgy and Reactor Fuels Subcommittee.

ACRS members in attendance are Dick Skillman, Dana Powers, Dennis Bley, John Stetkar, and the inestimable Joy Rempe, who is conflicted to some extent. You're going to announce it? Not on this one? Okay. Ms. Maitri Banerjee is the Designated Federal Official for this meeting.

Today, we have members of the NRC staff to brief the subcommittee on their development and finalization of Regulatory Guidance 1.229, its final finalization, a risk-informed approach for addressing the effects of debris on post-accident long-term core cooling.

During our November 3rd, 2015 meeting, we received a briefing on the subject as it related to the proposed 10 CFR 50.46c rulemaking. The staff has incorporated comments from the public nuclear industry and NRC offices, and it's getting ready to finalize and issue the regulatory

guidance. We also have Mr. Larry Naron representing NEI to provide us with the industry view on the subject regulatory guide.

The rules for participation in today's meeting were announced in the Federal Register on March 8th, 2016. The meeting was announced as an open-to-public meeting. No requests for making a statement to the subcommittee has been received from the public.

We have one bridgeline established. Oh, and I should say that I believe that Mike Corradini is on the line or will be -- he is on the line. Okay. To minimize disturbance, the public line will be kept in a listen-only mode. The public will have the opportunity to make a statement or provide comments at designated times toward the end of this meeting.

I now invite Joe Giitter, Director of NRR Division of Risk Management, to introduce the presenters and start the briefing.

MR. GIITTER: Thank you. Yes, I am Joe Giitter, the Director of the Division of Risk Assessment in NRR. This morning, you will hear a presentation from the staff on a regulatory guide that supports a risk-informed approach for

addressing the effects of debris on post-accident long-term core cooling. The staff has worked hard and long to develop this regulatory guide, and we believe it is ready for use by licensees who utilize a risk-informed approach to address a GSI-191.

Ideally, this draft reg guide would have included more realistic methods, which appeared in an earlier version of the draft reg guide. The Office of Research and NRR have formed a working group which is tasked with resolving some of the issues that were raised with the more realistic approach. I'm hopeful that this working group will have completed its efforts by the end of the year. However, the current version of the reg guide is available for use now and is based on tried-and-true methods that have been demonstrated to be effective in applications.

We are hopeful that you will endorse the use of this reg guide as part of the regulatory guidance supporting the 50.46c rule. I appreciate the effort of the ACRS.

I will now turn the meeting over to C.J. Fong, Steve Laur, and Stephen Smith of the staff who will go into more detail on the draft reg

guide. And I did want to point out before we do that, on my left is Jessica Kratchman, who is the 50.46c project manager. Thanks. C.J.?

MEMBER POWERS: Before Mr. Fong gets started, I just had a question. You emphasized in your description that the methods are available for use and that they have, and I highlight the word demonstrated, to be effective. I wonder if you can explain that because it seems to me the most striking feature of this whole reg guide is that it has not been demonstrated under realistic conditions to be effective.

MR. GIITTER: That statement, for example, the reg guide borrows from other proven methods. So an example is, and C.J. will go into more detail on this, but it's based, in part, on Reg Guide 1.174; Reg Guide 1.82, which deals with head loss; NUREG-1855, which deals with uncertainties. All of those methods have been incorporated into the method in this draft reg guide.

MEMBER POWERS: Well, I mean, that's all well and good, but the real question is demonstrated strikes me as one of the, if I'm looking for a flaw in this whole thing is nothing

has been demonstrated on anything that is what you would call prototypic conditions.

MR. FONG: We'll get into that. That's a fair question. I have a couple of slides that can talk about that, Dr. Powers.

MEMBER POWERS: It seems to me that, at this stage, we need to sit down to look at this in the terms of what can possibly go wrong here? You know, what are we leaving out and things like that, and I'll try to bring up one or two things that came to mind.

MR. FONG: Dr. Powers, again, I think we'll certainly get into that, but I would say one other thing, in addition to Joe's comments, we do have a pilot that we've been working on for quite some time. Like any reg guide, the first time it's rolled out, it's hard to say that it's been 100-percent demonstrated because there's a first time for everything. But I am confident that the reg guide is usable based on the staff's insights gained from the pilot review.

MEMBER POWERS: I guess I have a great deal of confidence that people can use the reg guide, a great deal of confidence in that. What I am concerned about is that when, in fact, we have

to check and see if these analyses have, in fact, resulted in a system that's function, that it is, indeed, functional.

MR. LAUR: If I could just build on what C.J. and Joe said, maybe it was stated too strongly. This reg guide builds upon existing reg guides. Obviously, there's new material in it. In other words, how you apply the risk-informed approach to this specific application. But I think what Joe was trying to say is that the Reg Guide 1.174 gives us a framework for risk-informed changes to the licensing basis and the other reg guides give us ways of calculating the deterministic aspects.

This particular reg guide doesn't conflict with those. It enhances those. And to the extent practicable and or practical or one of those words, it enhances places that don't have enough detail for this particular application.

The one thing that, I guess, prompted me to turn the mike on is this is the risk-informed process, so we have not only the risk insights but also the safety margins and defense-in-depth aspects. And that's one where Reg Guide 1.174 has seven very general things to consider. We try to

provide more specificity here. Their thing is it has performance measurement as the fifth key principle in Reg Guide 1.174, and here we say it's necessary to monitor after this change is made and ongoing to make sure there aren't unintended consequences and that the consequences we hope to get, the intended consequences, are achieved.

MEMBER REMPE: So I was looking at the reg guide and, again, perhaps this got discussed because some of this started before I even joined ACRS. But I was a little puzzled about how containment accident pressure is treated in this reg guide versus 1.82. Was there some agreement made that it's allowed now in this reg guide where I thought 1.82 basically didn't, it discouraged the use of it.

And so could you talk about that? Maybe you've already planned it in your slides, although I didn't see it brought up in the slides when I looked at them. But can someone refresh my memory on it?

MR. SMITH: So the intention would be that Reg Guide 1.82 would continue to be applied when this reg guide is being, you know, when this reg guide is being implemented. Some plants have

can credit containment accident pressurce, so if it's already in their licensing basis we wouldn't take that out.

MEMBER REMPE: But if it's not, you're not going to let them use it?

MR. SMITH: If it's not, they would have to justify or they would have to get a license, it would have to be part of their license amendment request to allow the use of containment accident pressure for --

MEMBER REMPE: Okay.

MR. FONG: Okay. I'm going to suggest that we start the slides, and we can continue the dialogue as we go. All right. So we have three objectives. The first is to provide a status of the reg guide and let you guys know where we are. Second, I'm going to highlight some changes that have taken place since the last time we spoke in front of this subcommittee. There have been a few discussions in front of the full committee on the reg guide and also the rule itself, but we're going to highlight the deltas between the reg guide that was discussed on November 4th of last year and the reg guide as it stands today.

We've seen some questions from various

stakeholders on the difference between the so-called detailed approach that's in Appendix A and the simplified approach in Appendix B. So we're going to discuss that a little bit and hopefully clarify the difference between those two approaches.

So where are we today? Well, when we last spoke in front of the subcommittee, Reg Guide 1.229 was still in the internal concurrence process, and there were still a variety of changes that either were made, you know, around the time of the meeting and subsequent to the meeting. And so I wanted to highlight a big difference where we are today versus where we were back in November.

Today, the reg guide has completed the concurrence process, has received a finding of no legal objection from the Office of General Counsel, has stabilized. As you see here, the concurrence was achieved on February 8th. No changes since then, so the version that was sent to the ACRS Subcommittee a little over 30 days prior to this meeting, that's it, that's the version.

Obviously, changes can still occur. If the Commission tweaks the rule or, you know, other changes are necessary, we certainly can do that.

But I want to be very clear that this is not a reg guide that started in flux or that there's a bunch of ongoing changes. This is, we believe this is our best shot. We believe this reg guide is ready for use, and this is a stable and usable version.

To highlight a couple of the changes, I first wanted to mention that there was a minor change to the reg guide necessitated by a change to the rule itself. And this was discussed, just to refresh your memory, Mr. Chairman, back in the February 4th full ACRS meeting. And then we changed the rule language a little bit to clarify that not every single change to the analysis would require a licensee to come back to the NRC staff with a LAR. The rule, as originally written, could be interpreted that way, and we wanted to clarify that, certainly while some changes, particularly a significant change to a method, switching to a seismic PRA from a margins analysis, changing, you know, drastically changing the LOCA frequencies that were allocated, something like that, would require a change. But minor changes we felt the licensee should handle. So the rule language itself was clarified in Part E.3, and we made a simple conforming change to the reg guide to

reflect that reality.

The more substantive changes that have taken place since November of last year are really found in Appendix C. And if you think back to November, Appendix C originally had three methods for partitioning a plant-wide LOCA frequency on individual occasions, and this is something that has been discussed quite a bit in the last several meetings. But just as a reminder, originally we had three methods of so-called bounding approach, what we called a conservative partitioning, and a semi-quantitative partitioning. And so those kind of go in order of realism, in a sense. The bounding tends to produce the highest delta CDF results, conservative partitioning is kind of in the middle, and, in method three, semi-quantitative partitioning tends to produce lower results.

As we went through the internal concurrence process, we really had a tough time getting full alignment on methods two and three. And so we made a decision that we would move the reg guide forward only retaining method one. Although it's a little conservative, we thought it was usable based on information we received from the pilot, and the decision was made, as Joe

mentioned, to continue to work on methods two and three.

MEMBER STETKAR: So because you received information from South Texas, which looks like no other plant in the country, then only the conservative method applies for every other plant in the country?

MR. FONG: Well, I'd point out, Mr. Stetkar, it's a reg guide, so licensees are free to come forward with alternate methods if they see fit. We felt that only method one was ready for prime time at this point, and we're going to continue on our own working on methods two and three. But, of course, licensees, if they feel that method one doesn't suit their needs, they're welcome to propose other methods, as well.

CHAIRMAN BALLINGER: I just got an email from Mike Corradini. He'd like to ask a question. He said he's on mute.

MEMBER CORRADINI: Can you hear me?

CHAIRMAN BALLINGER: Yes, hear you fine.

MEMBER CORRADINI: Okay. All right. So my question is following up Mr. Stetkar's question. My feeling is, unless I misunderstand

Appendix C, that the staff is going to have to go in with a number of individual case-by-case exceptions to the Appendix C guidance because it doesn't seem to follow what I remember to be what you use, I guess, assume is the pilot. Am I misunderstanding?

MR. FONG: Well, Dr. Corradini, I don't think the staff needs to start doing a bunch of one-offs. We feel that method one, again, while it tends to be a little on the conservative side, is a usable method that licensees can use right now. It's simplified.

MEMBER STETKAR: My point, C.J., is you use the term here on the record a little bit on the conservative side. My question is what basis do you have for a little bit on the conservative side? Because you only have one partial analysis for one plant that doesn't look like any other plant in the country in terms of their conditional core damage frequency, the number of trains of equipment they have, and so forth and so forth and so forth. So why do you know that it's a little bit conservative for everybody else in the country who might use this?

MR. FONG: Right. So there's two

things that we've done.

MEMBER STETKAR: It might be a lot, a lot, a lot conservative, and I'll take that approach.

MR. FONG: It's going to depend on the plant absolutely.

MEMBER STETKAR: Okay. Well, then why don't you allow other plants in the regulatory guidance to use more realistic approaches that the staff has thought through, without going into, as Mike said, this sort of one-off, everybody gets a separate evaluation because everybody needs to use some little trick that --

MR. GIITTER: Dr. Stetkar, let me try to speak to that. I think the staff intended to include all three methods in the reg guide. And in the concurrence process, we were unable to get concurrence from one of the offices involved in reviewing it. And an assessment was made based on the extent of the comments that it would be more expedient for us to move forward with the one more conservative method and continue to work on refining and addressing the comments on the remaining two methods.

MEMBER STETKAR: Well, could you -- I,

unfortunately, wasn't at the subcommittee meeting last fall where I understand this was discussed at some depth. What type of comments and concerns did you get on those other two methods in the former version of Appendix C? What were the concerns?

MR. FONG: Sure. I'll give you an example. So the kind of overarching comment we got was that methods two and three have merit, but they're not quite ready for regulatory use. And so here's one example. Method three leverages information from risk-informed ISI, and it assigns a high, medium, or low relative magnitude for each location based on ISI insights. And what some folks pointed out was that risk-informed ISI doesn't include all the plant locations that are important to a GSI-191 analysis. For example, if you have a program, those locations are scoped into that specialized program and aren't looked at in risk-informed ISI space or aren't assigned a high, medium, and low. So there's a couple of gaps --

MEMBER STETKAR: But if I was a plant, couldn't I go out and look at those locations and do that assignment?

MR. FONG: That's what we do, sure.

MEMBER STETKAR: Well, okay.

MR. FONG: So that was the point that the whole method, it's not that the method is invalid. We just had some details that needed to be filled in before the method could totally be used, and that's what we're working on right now.

MEMBER STETKAR: Go on, Mike.

MEMBER CORRADINI: I'm sorry, I'm sorry. But then the intent is that this is, that the Appendix C is a living document, that we're going to see additions to it?

MR. FONG: I wouldn't call it a living document. I would call it a -- right now, it's the best available method that we have, and we're going to augment it with, hopefully, at least one or two additional methods by the end of the year.

MEMBER CORRADINI: Okay. Then the timing of doing it now versus doing it in a year is what? Why push forward now if you're not ready?

MR. LAUR: This is Steve Laur. There's a couple of things here. One is it looks like, you know, schedule pressure because it's tied to 50.46(c) rulemaking. But in actual fact, there's a lot of good information in this regulatory guide beyond just how -- this is obviously a key part -- but beyond just what's in Appendix C. There's all

the parts about the monitoring program, the defense-in-depth, how you evaluate that, how you do the head loss, debris transport, etcetera. All that is in there, and most of that has been based on an experience from a pilot program.

So, you know, we can hold off until we have a perfect Appendix C with technically justifiable methods, which is what we're really lacking now, in my opinion, is the technical basis for methods two and three. It turned out to be not an easy fix but a little more thorny problem, so we're hoping with this working group between research and our office to have something for a revision to this reg guide hopefully, as Joe said, by the end of the year. But to hold the entire reg guide with all the other guidance in advance until then didn't seem to be the proper thing to us.

MEMBER CORRADINI: So just to clarify, so you are going to look for a change, so that means certain licensees are going to use this in this interim time period of the next nine months that they need to see this and get started?

MR. FONG: Yes. And just to be clear, we have only one docketed submittal right now, which is the South Texas project you'll hear from a

little bit later. We do have preliminary information from public meetings and other sources on some of the first non-pilot plants, and so this was not done in a vacuum just to look at one licensee. We took all the information we had that was available to us at the time when we made the decision to move forward with just method one.

MEMBER CORRADINI: Okay, all right. What strikes me is, I think it goes back to Dr. Powers' point that there's a pilot that's in process. And unless I misunderstand -- and there's a lot of good stuff in the reg guide. But as I understand, it's fashioned basically with that knowledge of that pilot, which is yet to be finished. So I'm still struggling to understand the need to push forward at this point since some of these things seem, John uses a bit conservative, I can't tell, but it's one pilot that hasn't been completed.

So I'll stop. Thank you. And I'll go back on mute.

MR. D. HARRISON: This is Donnie Harrison from the staff. I would just point out, and pardon me if I'm wrong, C.J. and one of the Steves, but the non-pilot plants are more aligned

with the simplified bounding approach. So that's, so it's not that that approach was developed for the South Texas pilot. It's actually kind of a reverse. It's actually the approach that the 13 - 14 non-pilots plan to use, and then we're conforming South Texas to it at this point.

MR. FONG: Okay. We talked about some of this already, but the path forward on Appendix C. Again, we believe that the current reg guide is ready to be used, and the bounding method that we've talked about is suitable for the pilot. Of course, we're going to evaluate experience as we go and complete the pilot, and we'll revise the reg guide as necessary. And, as Joe mentioned and we talked about before, we're currently working on some additional methods to go into a revised version of Appendix C.

Just some detail on what that looks like. We had a meeting between NRR and research back in February and an agreement to augment Appendix C with more realistic methods. So we have a written project plan on how to do that. We've identified the key staff that will be working on that effort. They've put together a series of milestones and key actions that need to take place.

And as Joe mentioned, we're going to attempt to complete that by the end of the year or possibly early next year.

Now I'd like to shift gears a little bit and talk about the difference between the detailed approach in Appendix A and the simplified approach in Appendix B. Appendix A, the detailed method, what you're going to see is different basic events that are added to the PRA model. For example, a basic event for strainer failure, loss of NPSH of the strainer, and a basic event for core blockage. And you'll see a variety of models that are used to estimate a failure probability for those basic events based on what happens on the debris generation and transport phase, and you'll see a probability that's assigned based on a variety of different conditions.

And so I think a key element to that approach, if you're looking for a delta between the two, is that in Appendix A you're going to see a correlation of time versus head loss, correlation that's used to derive the probability of these new basic events; whereas in the simplified approach in Appendix B, what you're going to see is what I call go-no-go test, so there's going to be a comparison

of the degree, for example, at the strainer compared with an existing test data. And you'll see a conditional core damage probability of zero if the debris that's calculated, its generating transport, is below that threshold or 1.0 if that degree amount is above the threshold.

So you don't have a time versus head loss. You don't have a probability. Just go-no-go for each break scenario.

MEMBER STETKAR: C.J., I have a lot of questions on the reg guide. You guys don't have a lot to present here. Okay. You're apparently done with this, so I can ask all my questions. You mentioned Appendix B says go-no-go. That implies that if something, if go means I have less than 2.77736 and I calculate that I have 2.7735, I pass; if I have 2.7737, I fail, whatever that is.

How do I account for uncertainties in all of this? Now, you very clearly say that whenever I calculate LOCA frequencies, I have to account for uncertainty. How do I account for all of the other uncertainties when I do this simplified approach, like uncertainties in the amount and types of debris, uncertainties in the transport, uncertainties in actually what will

plug? Because everything else is as, if the wonderful deterministic folks know what those numbers are after those six significant figures or whatever I babbled, so how do I account for all of those other uncertainties?

MEMBER POWERS: Yes, that is not the problem.

MEMBER STETKAR: That is not the problem?

MEMBER POWERS: The deterministic guys may well know things out to significant figures.

MEMBER STETKAR: They think they know that.

MEMBER POWERS: What they don't know are the phenomena that appear under realistic conditions and at these simulated or not anticipated.

MEMBER STETKAR: I characterize all that as part of my uncertainty about whether I pass or fail.

MEMBER POWERS: The uncertainty is the issue. The really catastrophic uncertainty are those things that don't get simulated when we do experiments to validate the deterministic analysis.

MR. SMITH: The staff is aware that

there is a significant amount of uncertainty in the calculations that are done strictly to determine how much debris gets to the strainer and how much head loss that that debris is going to cause. So we have a reg guide, Reg Guide 1.82, and it incorporates a lot of things through reference, but our conclusion when we developed that reg guide was that it was significantly conservative to make up for a lot of these uncertainties.

So that is, that is the way that we deal with those types of uncertainties, not the break frequency uncertainty. These plants that are using the simplified approach are following the Reg Guide 1.82 guidance, and this is the same guidance that we apply to plants that are not using a risk-informed resolution. And we believe that those plants are, you know, they're dealing with --

MEMBER STETKAR: We believe that plants were safe from fires because everybody followed or thought they were following Appendix R. We found in risk assessments that isn't true when people look at more things more thoroughly and account for uncertainties. So I guess I'm challenging the staff about how this whole process accounts for uncertainty. Just simply saying that, well, you

have to account for uncertainty in the LOCA frequency because I can look up in a table in NUREG-1829 -- and those folks have to own those uncertainty distributions. You don't. Nobody else does. They're there for me, so I've got them. I don't get it.

MR. SMITH: The way that we're combining the two aspects of this --

MEMBER STETKAR: You're presuming --

MR. SMITH: -- resolution --

MEMBER STETKAR: -- that a point estimate for debris generation, debris transport, debris accumulation on the strainers, chemical effects, strainer pass-through, debris accumulation on the core, you're presuming that all of that stuff is somehow conservatively bounding without ever having assessed the uncertainties.

MR. SMITH: That's correct.

MEMBER STETKAR: Okay, thank you.

MR. SMITH: And I think that that's, you know, we've been in front of this committee with our deterministic resolutions, and I believe that it's been accepted by the committee, you know, the methodology that we use. And I think the way that we're combining the deterministic methodology

with the risk-informed methodology is just building on, you know, previously-accepted methods, and I don't see that we've left a gap in there where we don't treat uncertainty.

MEMBER STETKAR: I didn't do this last week. I'll do it during the break. I'll do a word search on Reg Guide 1.82 and see if the word "uncertainty" pops up in there anywhere. I'm not sure whether it does or not.

MR. FONG: Do you want me to move forward, or do you have an additional question that you wanted to ask --

MEMBER STETKAR: I have a lot of questions on the reg guide, and, since your next slide says conclusions, I can either wait for you to finish that, if you'd prefer to do that. Why don't you do that?

MR. FONG: Sure. Just four conclusions. You've heard me state them a little bit earlier. We think the reg guide is ready to go, and it's completed the concurrence process. You've heard Joe talk about how it utilizes and relies on existing tried-and-true processes. And as I said earlier, we are working on developing some additional methods in Appendix C for one

specific area, for LOCA frequency allocation. But as Steve Laur mentioned earlier, we think there's a lot of really good guidance in the reg guide that's ready to go. We didn't want to hold up all this other useful guidance just for this one step. And so we want to move the reg guide forward and get that guidance out to the industry where they can use it.

MEMBER STETKAR: I did my word search. The word "uncertainties" does crop up, so I can't say it doesn't. But I don't know how they're treated. Okay. If I do the simplified approach, according to Appendix B, and I conclude that the change in risk is acceptable, do I then need to change my base PRA to include those scenarios that I determine are assigned to core damage or, you know, assigned 1.0 conditional core damage probability or 1.0 conditional large early release frequency? Do I need to do that, yes or no?

MR. FONG: Well, we had a lengthy discussion, the staff had a lengthy discussion about meeting a base PRA. We believe the base PRA the as-built, as-operated plant represented realistically so --

MEMBER STETKAR: Good. That's my

interpretation. So now that we agree on that term, do I need to change that thing?

MR. FONG: Yes. I think, at any given time, it's your best estimate, it's the licensee's and the NRC's best estimate of what's really going on at the plant.

MEMBER STETKAR: That's not clear to me in the guidance. I read through the guidance in several places, and it never told me that I need to go change my PRA after the submittal is accepted or approved, you know, so that those scenarios that were assigned to core damage or large early release, according to the simplified method, are not part of my PRA for the as-built, as-operated plant. I could read the guidance to say I don't need to do that. That's why I asked the question.

MR. FONG: Yes, I certainly understand the question. I think we were trying to be careful here because we wanted to write a reg guide on how licensees calculate the portion of risk attributable to debris. There's guidance out there on what needs to be in your PRA for a given application, whether it's doing a significance determination process evaluation, a license amendment request. We want to be careful we let

that guidance do what it needs to do.

For example, for what needs to be in a PRA, there's Reg Guide 1.200, and that's the PRA standard. We didn't want to try to cross over into that world. We wrote a reg guide specifically for this application.

MR. LAUR: Just to add to that, but I think a reading of the reg guide would lead you to believe or you should be able to infer from the reg guide or maybe it's explicit that the licensee has to maintain the risk-informed assessment of debris over time.

MEMBER STETKAR: Yes.

MR. LAUR: You're right it is mute on whether or not you have to update that into the PRA because I think where you're going with this is that this is going to be grossly conservative in most cases, it will be a lump that you add to the base PRA that would be useless. In most of your calculations, it would never show a delta, unless you did the Appendix A method where you actually have it in the model. But it is important that the licensee update this specific analysis, even if it's the simplified approach, periodically to ensure that they meet the acceptance criteria.

MEMBER STETKAR: No, Steve. What I'm concerned about is that if they don't update their PRA -- and I'll get away from this notion of base versus whatever. It's the PRA of the plant. If they choose to take this risk-informed approach and say, well, we're going to do a simplified conservative analysis of this particular issue, the same way as I do a simplified conservative analysis of a lot of other issues in the PRA, this just happens to be one of them, if I do that then here are the implications in my PRA today of doing that analysis. And some sequences in my PRA then get assigned to core damage and perhaps direct large early release. Fine. You know, I do that with a lot of things in my PRA.

If something comes up later that I then need to use my PRA to address, whether that's a risk-informed application for some other issue or whether it's some sort of episodic event that I need to use the PRA to argue with the staff about what's the delta risk of this particular event or whether it's significance -- whatever I'm going to use my PRA for, ought not those sequences be in that PRA?

MR. LAUR: Yes, I think C.J.'s answer

was on point there.

MEMBER STETKAR: Okay. And as I said, it's not clear to me reading, there's a big long section of part of Section C.1D that says, well, if you're consistent with the rule, you can use the simplified approach and you got to go do these things. It leads me to believe that I don't need to do anything else --

MR. LAUR: Each other application has either Reg guide 1.174 and/or a specific reg guide for that application.

MEMBER STETKAR: Is the use of my PRA to answer a question about the significance determination process or answer a question about some episodic event that has happened in industry a risk-informed approach that applies under one of those other reg guides?

MR. FONG: Strictly speaking, no.

MEMBER STETKAR: Thank you.

MR. LAUR: But then, again, there's no requirement to update the PRA, unless you have --

MEMBER STETKAR: Yes, if I tried to use my PRA for one of those things and I didn't evaluate loss of off-site power, would you have a problem with that, even though there's no

requirement that my PRA has to meet Reg Guide 1.200?

MR. LAUR: Yes, I'd have a problem with that, but I'm failing to make the connection here.

MEMBER STETKAR: Your point is that my PRA ought to be my PRA. Some of the things in my PRA are more realistic, some of the things in my PRA are more conservative. But it's my PRA, and I've got to live with it, and I've got to live with it from this point forward, for whatever reason I want to use it, whether it's just discussions with the staff or whether it's an actual risk-informed application under some other regulatory guidance.

And as I said, as I read this regulatory guidance, I could come to the conclusion that all I have to do is some one-off calculation, say I'm fine, keep my PRA unchanged, and then four years later look at it and do the same one-off calculation and say I'm still fine.

MR. LAUR: Right. And if you never use the PRA for anything else, that would be acceptable for this application. I guess, in my opinion, this is not the reg guide where you would put that --

MR. FONG: That's what I was saying. There is guidance out there for the different ways

in which PRA is used: changes to a licensing basis, looking at inspection findings, MSPI. And there's a lot of different applications for PRA, and there's application-specific guidance out there that's already in play. And so we didn't try to go out and re-write the rules for all those other applications. I don't think that would have been appropriate for us to do that here.

CHAIRMAN BALLINGER: Before we get to the next question from John, I've got an email from -- I'm trying to do parallel processing here -- from Mike. He says, "Dana feels that they are missing a phenomena," with an exclamation mark, as he hinted what is missing, chemistry effects. So I guess it's a question for you. I'm just reading from the -- you know, what would you like me to do? He's listening. He may not be able to talk, but he's listening.

MEMBER POWERS: That's the best possible situation.

CHAIRMAN BALLINGER: He's fine. He's sending me emails back and forth here.

MEMBER POWERS: I'd be happy to point out lots of things they have not considered, but anything that gets considered, by definition, can

get addressed. It's the things, it's the famous we don't know what we don't know kinds of things that bother me.

Now, when I say they have not tested under productivity conditions, for instance no radiation field. Does radiation field affect filtration performance and things like that? Yes, it turns alkenes into ketones, ketones can polymerize. So it can affect things. Now, is that going to be a huge effect? I don't know. If I were doing the deterministic analysis, I would say, you know, if I'm a staff member working, oh, it's probably a small effect. But I don't know, and you have to recognize that you don't know.

But those things, I can take account of those things. It's the things that I don't think of that we really need to worry about. And what I'm asking about is have we carefully considered how things can go agley, as they say here, in formulating this reg guide and thinking that it's somewhat conservative. Is it in fact, and could we design some strategy where we can validate this? That's very difficult.

I mean, I keep hoping for a plant in Iran to fail, but it's not going to have all the

systems there and it's not going to be instrumented and there's just going to be one accident when it does. So it's less than a perfect test, and that will always be the case. I mean, that's one of the strongest motivations I can think of to go to a risk-informed kind of approach here is because you will never have perfect information on this system, even if it's incorporated in a plant and that plant undergoes an expected accident. That will still be one data point.

And so that's what I'm asking about is how big is that we don't know what we don't know portion of this pertinent to this particular reg guide and how do we cover ourselves on that?

MR. SMITH: I guess I can't disagree that we don't know what we don't know.

MEMBER POWERS: Yes. I mean, there's always going to be something, right?

MR. SMITH: I'm just going to kind of repeat what I said before. We have deterministic guidance, which is, you know, acceptable to the NRC, which we are using in this reg guide, and I think the way that we're using it, we haven't, we haven't eroded any of the conservatism that's built into that.

So I don't really know, you know, other than going back and revising our deterministic guidance, taking another look at that, which we are always looking at that, you know. When we find out new things, we try to take those into consideration. I don't know what we would do, you know, within this reg guide to resolve that kind of issue.

But, you know, the people who evaluate this, we think we have a pretty good framework for doing the evaluation that has conservatism built into it, and we understand that there are unknowns. For example, you know, we've been through a lot of, we've looked at the chemical effects and radiation effects and things like that. Of course, we don't --

MEMBER POWERS: I haven't really seen anybody look at the radiation effects in what I would call a systematic fashion. Again, if I were working for you and you asked me to look at that, I'd probably come back and tell you, well, it's probably a small effect. The grosser chemical effects, what I would call thermal chemical effects, we've kind of looked at and we don't really understand, but we've kind of looked at. We

have, I hate to call it an intuitive feel, but we have something in an experimental feel for how weird it is. We have semblance that we're kind of comfortable with. You know, I would put it, if I were you, put in user needs that, God, if you ever find out anything more about what's in the sumps at Fukushima, for God's sake, tell me because, you know, that's the kind of prototypic data that you'd really like to know to know how good things are.

MR. FONG: I think one other important -- that's a great answer.

MEMBER POWERS: If you do have somebody that's looked systematically -- I mean, I won't worry about these chemical transformations that occur in radiation fields a lot, especially with organics. So if somebody has looked at that in a systematic fashion, I'd sure like to see it because, otherwise, I haven't.

CHAIRMAN BALLINGER: Are you arguing for a conservative approach to account for that?

MEMBER POWERS: Well, no. I think, as I've said explicitly, I think a risk-informed approach is the only way to address these kinds of concerns because you will never know what you don't know. Never. I mean, it's a tautology.

MR. FONG: And one thing I wanted to add, Dr. Powers, is, of course as you know, a key part of the risk-informed approach is having a defense-in-depth strategy. So if you look at what the reg guide does, it has the licensees identify what sequences are going to lead to core damage and quantify those, but we don't stop there. We also, to account for unknown unknowns, as Reg Guide 1.174 has us do, we have the licensees define a defense-in-depth strategy that looks at what if we're wrong and one of these scenarios happens.

MEMBER POWERS: Yes, it's, it would be good if the licensee did exactly that, which is how can this system fail? You know, what does it do to cause this system not to work? But that's not what they do when they do defense-in-depth. When they come to that part of 1.174, they string together a bunch of lists of things that bolster their conservatism. I would be much more comfortable if they would come in and say this thing all works unless there's kryptonium in the solution and then kryptonium screws it all up or something like that.

I am reminded of once being in a position of having to identify ways of preventing refinement of radiated reactor fuel, and I spent a

week with people that do that at Rocky Flats, and they assured me in no uncertain terms that their refinement techniques would work on any kind of fuel I would deliver to them of any sort. It went on at elaborate lengths. I thanked them very much, and, on the way out, the guy says, "Well, make sure you don't put any silicon in that fuel. Our columns can't tolerate salicylic acid." This is what I was looking for all the time. It's those things that surprise you, and you know, as well as I do, as soon as you get the surprise, oh, of course I knew that. So many times it happens.

MEMBER SKILLMAN: I'd like to jump in here for a second, and I want to build on John Stetkar's questions. The way this document, this reg guide is written, on page 17, an entity seeking to use this approach is required to submit an application. I spent a lot of time at sites, and when a site makes its mind up that it's going to make a major change and it's going to produce a license amendment, that is a big deal. It's also an expensive deal. It's time consuming and almost always means consultant resources, as well as probably some of the finest analytical resources in the organization.

So when a utility decides or an owner decides to go down this path, it necessarily begins to build another analysis that looks like it's PRA, but it's really a GSI-191 dedicated PRA, correct? It's a dedicated GSI-191 PRA. Simple.

MR. FONG: Which approach are we talking, the detailed or the simplified?

MEMBER SKILLMAN: I'm on number nine of your reg guide, and I'm a licensee and I'm reading this and I'm saying, hey, if we want to use a risk-informed approach, we've got to submit a license amendment request and we've got to do a special PRA just for this 191, at least a calculation that looks like a PRA. Is that right?

MR. FONG: Well, it's up to the licensees how they would want to do that. I mean, I think we would expect that a licensee would try to start with an existing PRA model they had, unless it's built something completely from scratch. But we'll review whichever, whatever the licensee submits to us.

MEMBER SKILLMAN: And what's your expectation?

MR. FONG: That they would start with an existing model, modify it as necessary to

calculate the risk attributable to debris.

MEMBER SKILLMAN: So would they end up with two counts or just one count?

MR. FONG: Well, they would have, I think, two counts, one for in-vessel, one for strainer. Two basic events is what we've typically seen licensees talk about doing.

MEMBER SKILLMAN: Isn't that what John was talking about? Here you have this main PRA for the unit, and now you have this calculation that is the calculation for Reg Guide 1.229. And the reason I'm asking this question is because it seems to me that it raises some either configuration, some documentation and analytical configuration control challenges or some harmonization questions. And what can be a burden on the licensee is ensuring that the GSI-191 calculation and the main PRA for the unit remain consistent, aligned, and accurately true to each other. How does this make sure that happens? How does this make reg guide make sure that that consistency remains?

MR. FONG: So, I mean, what you're bringing up and I think what Mr. Stetkar brought up earlier is a broad question that we face in PRA all the time. We've seen licensees come forward, for

example, provide information for us in the significance determination process, and they'll say, "Well, we don't want to use our 805 PRA. We have a different PRA."

So this kind of thing happens. Licensees sometimes have different PRAs for different purposes, and I don't think it's the job of this reg guide, unfortunately, to solve that broadly. I think if a licensee goes forward and they create, say, two new basic events used to calculate the risk attributable to debris for this analysis, your question is a very fair and reasonable one. What happens to those basic events going forward for, say, mitigating strategies Fukushima PRA or something? I don't think we can solve that with this reg guide. There's guidance out there on risk-informed laws, SDPs, all the various applications of PRA that licensees need to follow.

MR. LAUR: Yes, I don't know if this will help or not, but, okay, let's assume we're using a simplified approach. We do a test, which has a lot of uncertainties but hopefully some conservatism in it, and we say that's our go-no-go. We use conservatism maybe in how we put the entire

LOCA frequency on one weld that's the smallest, whatever the simplified approach says. You could do that portion of it without your PRA at all. What you're doing is an estimate of the risk attributable to debris, and you show that it's small and consistent with the Commission's Safety Goal Policy Statement, which means you've met one of the five key principles that are in Reg Guide 1.174, and that will be it. If you never intended to use your PRA for anything else, we would have no hook to require you to update the PRA, and this analysis would stand on its own.

Now, as C.J. pointed out, when you come in for some other application, Reg Guide 1.174 has got the total plant risk on one axis and the delta plant risk on the other axis, this would have to be added in there, which I think the issue we're debating or talking about here is the fact that this bounding approach, in my opinion, other than the deterministic part which I can't speak to, it's very bounding potentially, it's very conservative. That has the potential of maybe skewing your total risk number. You're going to have this large break LOCA that's a larger term than it would be if you didn't have debris, and we don't know how much

larger it is.

But, yes, to answer your question, this reg guide does not really talk about the baseline PRA model to the extent that -- it really talks about how you calculate the risk, the change in risk for this application. I don't know if that helped.

I guess your other question is about the application, and I guess I didn't understand that one about requiring an application. That's not really required here. That's required in the regulations --

MEMBER STETKAR: No, sir. No, sir, it's required here, page 17, item nine. It's in your reg guide.

MR. LAUR: Yes, but the reg guide doesn't require it. It's 50.46(c) that will require it, or, if that never becomes a rule, it's the fact that this is an exemption that requires it. But this reg guide is merely repeating a requirement that's elsewhere.

MEMBER STETKAR: Okay. That helps. Thank you.

MR. D. HARRISON: This is Donnie Harrison of the staff. I just want to clarify most

of these plants have a basic event in their PRA model that's a black box. It just says sump clogs. It's given a ten to the minus six failure rate. So when someone decides that they want to use this risk-informed approach, they are going to need to change that basic event to reflect what the actual condition of the plant is when they're done. You're no longer going to have a black box event that says ten to the minus six sump clogging. It's going to be here's my model for debris and, if you do the simplified go-no-go, it's going to be a lot of, for this scenario it's 1.0.

So they are going to have to do that to make that work. Otherwise, their PRA base model won't be correct. It won't be reflecting the as-built plant. So I hear Dr. Stetkar's point. It's worth noting and going forward. It was a debate we had a few months ago about the terminology in the existing reg guide at that time about what is a base PRA.

So I think we've taken the note. It might be worth considering if we should at least put a note into the reg guide or somewhere the expectation that you would update your base PRA to reflect what your current plant configuration looks

like after you do this analysis. That way, it doesn't get lost going forward. I think it's worth noting.

CHAIRMAN BALLINGER: That's very helpful. Thanks.

MEMBER STETKAR: Let me try, since we're talking about base PRA, I'm going to come back to uncertainty. We have two and a half hours left, I think. If I look at the guidance in Appendix B now, if I'm going to do the simplified approach, Section B.1 tells me what I need to do from Appendix A, the detailed approach. And by omission, it tells me what I don't need to do from Appendix A. And one of the things that I don't need to do from Appendix A is PRA model changes, Section A.3. That's omitted from what I need to do.

So, okay, I don't do any PRA model changes. But Section A.3 talks about some really reasonable stuff because, in my PRA, I've got three trains. Let me call myself South Texas. Any one of those three trains is success, but, as we know, it makes a difference whether I have A and only A, B and only B, C and only C, A and B, A and C, B and C, or all A, B, and C running, and whether I've got

spray running in conjunction with that.

So there's a lot of different combinations of things that I can have going on in my PRA that will affect debris transport to screens and affect that number that I'm going to calculate. So if I don't change my base PRA to account for those things, how am I going to use what's in my base PRA to have any reasonable assessment of debris transport and debris deposition on screens so that they can come up with that number?

MR. SMITH: The way that that is treated, at least in the pilot in the simplified method -- and if other plants come in with different methodologies, we'd have to look at it -- they have basically maximized the debris transport, they've taken the design basis assumption that two trains are in service. So they've maximized the --

MEMBER STETKAR: No, no, wait a minute. Design basis assumption doesn't, nature doesn't know about law, okay? So I can have A and only A, B and only B, C and only C, A and B, A and C, B and C, or A, B, and C. Those are a -- if I have zero, that's core damage already, so I'll give you that one.

MR. SMITH: They've bounded, they have

taken the maximum transport that could occur, assumed it went to two strainers, and then they also did sensitivity studies that assumed only one train was running and the maximum transported debris to that single train strainer. So the way that the pilot plant did it --

MEMBER STETKAR: Okay, Steve, let me stop you there. Good for them. I don't see anything in this regulatory guidance that leads me to try to do that kind of an analysis. I don't see anything that says if you're going to take this simplified approach and you're not going to modify your base PRA to account for all of those myriad configurations that I can have, then here is what you should do. I don't see anything in here that says that.

MR. LAUR: I don't think you need to modify the base PRA to get those various combinations. If you're going to do a detailed approach in Appendix A, in which case you're going to have different flavors of basic events depending on whether it's train A, train B, train C, and, in fact, the pilot identified, I forget, 512 or something permutations because they've got three, you know, containment spray, three whatever, three

high head, three low head. So they had 512 which they've mapped into 64 by symmetry, then they pared down to five.

So in a detailed approach, yes, you would need to add logic to a typical PRA where you say large break LOCA and you don't ask, you just know it wouldn't work for the success, right? They actually modified the tree to put all the various branches.

But for the simplified approach, if you can somehow, without modifying the PRA, determine the transport for the various combinations, you don't need to modify the PRA. And that's what they did. They didn't consider the case of all three working. They said the case of two sumps working is conservative for the three, and then they considered the single case. They did use a PRA to determine a split fraction of being in one state or the other --

MEMBER STETKAR: Steve, that's my whole point. Good for them. They did a lot of work on their particular plant. And after they did all of that good work to come up with that information about which of these configurations might be the most bounding, then they said, okay, I'm going to

use this simplified approach and put some numbers in. This regulatory guidance is being written for everybody else, not them, and I don't see the regulatory guidance saying you ought to do something like that, whether it's actually something --

MR. SMITH: In Appendix B.

MEMBER STETKAR: In Appendix B. It says I need to do that in Appendix A. In Appendix B, all it says is I don't need to make any changes to my base PRA model, and I have to determine a threshold value for each debris type below which the debris cannot adversely affect -- it doesn't say that I have to go look for the most conservative configuration of all of my operating systems in the plant, not design basis, not licensing basis, not assumed for an FSAR, but the most conservative configuration, and then do my debris transport and deposition under those conditions. It doesn't tell me to do that. It just says I don't need to make any changes and do some magic and come up with a number.

MR. FONG: It does say if you don't evaluate a particular scenario, you've got to take a CCDP of 1. So --

MEMBER STETKAR: The scenario doesn't exist. Let's take a simple place where I've got two injection pumps and two spray pumps, okay? And I have I think four combinations of those things running. It doesn't tell me to take the most conservative of those four combinations. All I know in my PRA is that I've got at least one running, and maybe I haven't even evaluated spray because it's only for core damage and I don't care about spray.

MEMBER BLEY: Conservative in terms of transport.

MEMBER STETKAR: In terms of transport. In terms of transport. You're not modeling transport here.

MR. LAUR: Let me just reiterate what C.J. said, B.3C, it says plant space and configuration not explicitly treated in a simplified approach and which would not screen out under B.1 should be assembly to core damage. Maybe what you're saying is it needs to be clearer, but it's not the PRA model that needs -- I mean, that may be one way of determining these plant states. But in a simplified approach, if you had to take a two-train plant, they can consider both trains

working or one train working.

MEMBER STETKAR: Does it make a difference if I have both trains of injection, both trains of spray, all four pumps running, any combination of those four pumps running? It might make a difference for core damage. It might make a difference for delta LERF.

MR. LAUR: Certainly. But the PRA model isn't what's going to tell you that, unless you modify the PRA model.

MEMBER STETKAR: My whole point.

MR. LAUR: But you can tell that without the PRA model.

MEMBER STETKAR: Yes, I can do a PRA, in principle, on an Excel spreadsheet with enough permutations and combinations. People don't try to do that because it gets real complicated.

MR. LAUR: But we're talking about debris transport under different pump running configurations.

MEMBER STETKAR: Yes.

MR. LAUR: What does it have to do with the PRA? That's all the phenomenological part that GSI-191 has raised, I guess.

MEMBER SKILLMAN: So let me jump in.

This is exactly the issue that I perhaps ineptly was trying to point to. Like John said an hour ago, the plant has one PRA. It's one huge calc. And what we're talking about here is, actually, based on the gentleman who spoke a few minutes ago, a sub-routine within this huge big calc is extraordinarily important to the conclusion of that calc. And the calc that I refer to is a capital C calc. It's the plant's PRA. And I'm thinking there ought to be one, not two. It ought to be integrated so that all of the other things that are going on concurrently are identified.

So I'm kind of stuck on this idea that this reg guide presumes that you can make a license amendment request for use of this methodology for treating GSI-191 when the validity of this is only as good as its place in the overall plant PRA. Maybe I'm coming at this -- I'm the guy that hiked down and found chicken wire as the screen in some of the emergency sumps. I'm the guy that watched Davis-Besse learn that if you took the take-off to cool the recirculation pumps to the side of the casing instead of the top of the casing, the pump would survive. If that change was not made, the pump would not survive. There are so many fine

details that are out in the field that affect this that maybe I'm affected from the practical perspective. But from my practical perspective, the sub-calc has got to fit into the bigger calc, and it all has to work. So I'm stuck on that idea.

MR. LAUR: I don't know if this will help or not, but I'll let one of my colleagues try. For the detailed approach and what South Texas, as the pilot, originally started out to do had a very complex phenomenological model feeding into a PRA, if you will. They identified, if I recall, seven failure mechanisms involving the screens and/or the core, different parts. Mechanical failure, you know, deposit section, etcetera. And they put those into two basic events, two primary basic events in the model.

But because of what Member Stetkar was saying, the different, you know, if you had one train working, no train working, all trains working, you get different debris loadings and everything. They had to look at a huge number of combinations, which they were able to move down into five, let's say representative types of thermal hydraulic situations.

So for each of these two basic events,

they had five flavors, five different failure probabilities, depending on where you were in this sequence, okay? That's a typical PRA approach. You've modified the PRA to have these, so you can differentiate between one pump and two pumps because we'd normally do that. And so they can put these basic events in, and then, for the initiating event frequency, they have the typical LOCA frequencies. When you get out, you hopefully will get a new CDF number and a new LERF number that show you the effects of debris.

Now, the phenomenological part was very complex. We couldn't understand parts of it. We were not sure about other parts of it. How you do the uncertainty through that parametric uncertainty is difficult to understand if you're averaging things properly, which is, I think, one reason that they came up with their simplified approach, which is a little different than what we have here but similar. Okay.

That is modifying the PRA.

Now, if all I'm interested in is the delta risk, I understand some of this stuff feeds into the PRA model, but if I didn't even have a PRA model I can do the simplified approach. I can take

these deterministic approaches to figure out how much debris is generated and transported under whatever, under 50, you know, 511 combinations if I wanted, and for each one of those I could then go to each potential LOCA location, get a frequency for that individual weld, you know. That's part of the debate we're having. But I can do that and say, okay, this one, when it's all transported under this scenario with one sump running instead of two, I get this much debris, go-no-go. It's a go.

Next scenario, next weld. Go through all the welds, go through all the possible scenarios, assign a conditional core damage probability of 1.0 if it's above this hopefully conservative number, no core damage if it's low, and I'm going to get a delta risk. I haven't touched a PRA model.

Now, it's true if you're going to say, well, what's the chance I'm in one sump versus two sumps, you're going to go to your base PRA model. But that hasn't anything to do with the debris, that has to do with pumps starting and stopping and, you know, failing to start or failing to run --

MEMBER STETKAR: I guess, Steve, you know, my mind glazes over when I hear people say, well, I'm a PRA guy, I'm not a deterministic guy, so I don't understand about that debris transport. So I'll say I don't understand anything. My simple-minded approach is there's some likelihood of being in each of the possible configurations of the plant, and there is then some conditional likelihood, given that configuration, that a certain amount of debris from location A will be transported to the screens and the core, and there is some conditional likelihood, given that, that I win or lose. And I'm not talking about deterministic stuff. All I'm saying is that's my understanding of the world.

So I don't want to partition this up into, well, the PRA guys do this and the deterministic guys do that. That's the way the world works.

And now you're saying, well, I'm making conclusions about the delta risk. Well, the delta risk accounts for all of those likelihoods. Maybe I account for them conservatively, whatever that means. Maybe I account for them realistically, whatever that means. But the delta risk somehow

has to account for those likelihoods.

So what I'm asking is how does the guidance for the simplified approach tell me that I somehow need to account for those likelihoods, and, if I don't account for all of those relative likelihoods, at least search for the most limiting combination of running and not running the equipment and debris generation for each location such that I can then do what is determined, is called a bounding assessment? I don't see it telling me to do that.

If you're saying I can do it outside of the PRA, yes, I can have a spreadsheet where I have all of those likelihoods and all those 512 South Texas combinations and do all of those little side calculations. Okay. Well, to me, that smells a lot like a PRA, but, you know, you might call it something different, give it a different name. But it doesn't tell me to do that. It just tells me to define scenarios, and I don't know how I define those scenarios if I -- me, if it were me, I'd change the PRA model because that gives me those likelihoods, but I'll admit I can do it on the side. It doesn't tell me what I need to be careful about when I define those scenarios.

MR. SMITH: That's why we referenced to Reg Guide 1.82 to define the debris generation and transport part of this. And that's not in Appendix B, but it's up front, and that's why we talked about it. It's in the regulatory position section where we talk about that.

So that was the meaning of doing that, and I know I'm not answering your question about how this ties into a PRA, but that's how we tried to tell people that they need to use conservative methods to determine their deterministic parts.

MEMBER STETKAR: Yes, but it still gets back to this notion of likelihood and delta risk. Reg Guide 1.82 doesn't --

MR. SMITH: It doesn't talk about that. Absolutely.

CHAIRMAN BALLINGER: I had a question from Mike Corradini. He says that that Joy could do it as well as I did. At the top of page two of Reg Guide 1.229, we see bold words. This reg guide describes acceptable methods and approaches for addressing 10 CFR 50.46(c)(e), alternative risk-informed approach for addressing the effects of debris on long-term cooling and applicable portions reporting corrective actions, da, da, da. Then

here's the bold part, "While the general risk-informed approach of this reg guide may be applied to any reactor designed within the scope of 10 CFR 50.46(c), many of the specific approaches, e.g. WCAP 16 530 MPA, for chemical effects and acceptance criteria, were developed for the current fleet of pressurized water reactors. Entities, licensees, or applicants using this guidance should justify that the application for each approach or method used meets the intent of this guidance."

And here's his question, "I'm not sure what this means. Does it mean that the staff does not expect BWR licensees to use this reg guide since it will pass the deterministic approach?"

MR. FONG: So I'll field that one. First, I guess, since the font is not bold, I guess Dr. Corradini means the words themselves are bold, so I'll be careful here.

CHAIRMAN BALLINGER: Well, okay. He said see bold words. I was looking for the top of page two, and I couldn't find it so . . .

MR. FONG: What that means is this: when we set out to write this reg guide, we started by looking at PWRs, BWRs, SMRs. People said what about large light water reactors? What we found is

this, there's so many different analyses that need to be done. You've got to look at coatings. You've got to look at debris. You've got to look at different ECCS configurations. It was extremely challenging to try to envision what that might look like for an SMR or even a BWR because we didn't have a pilot.

We also solicited feedback at a variety of public meetings from the industry and said, hey, anybody in the SMR community looking to use this? How about you guys? We didn't hear any feedback from a member of the industry saying we want this.

So given the challenge of trying to envision all these different specifics without a pilot and given the lack of demand for detailed guidance for another design, we chose to limit the reg guide, at least the things like WCAPs and referencing certain topicals, to the information we had: existing PWRs looking to resolve or respond to Generic Letter 2004-02.

We also think that's consistent with the direction we received from the Commission in two staff requirements memoranda where they said modify 50.46(c) to allow licensees to GSI-191, which, of course, is operating PWRs. But we didn't

want to give the impression that somebody else couldn't come in later and provide additional information and use the method, like, for example, in AP-1000.

So we wrote the guidance for the information we had today. But, again, it's a reg guide. Licensees can come forward and propose alternate methods. And if they are BWR, SMR, they would probably need to do that.

CHAIRMAN BALLINGER: Mike is off mute. Do you have any more things to say, Mike? I thought it was off mute.

MEMBER CORRADINI: Can you hear me now?

CHAIRMAN BALLINGER: Yes.

MEMBER CORRADINI: Okay. So what I hear as the answer is that BWRs are probably not going to use this.

MR. FONG: I can say that me, personally, and having asked the question in several public meetings, I have not heard a BWR licensee say that they want to use this. I can't tell you that, you know, you'll hear from the industry after us. Maybe they have a different perspective but --

MEMBER CORRADINI: Okay. All right.

Then I'll wait on the question. That's a fair way of putting it. We can get industry's -- I knew that they were going to say something. We'll wait until they come up then. Thank you.

But from your perspective, given the public comments and your public meetings, this reg guide and this approach was designed specifically to resolve a PWR generic issue, end of story?

MR. FONG: Yes.

MEMBER CORRADINI: Thank you.

MR. LAUR: This is Steve Laur. Just to add to that. The big-picture steps in Section C of the reg guide, not the appendices and not all the references to specific testing and other -- they follow the proposed rule that's up with the Commission now I guess, and those steps would apply to anybody. I mean, they talk about looking at the various scenarios that can be affected, how you, you know, looking at debris generation and transport, etcetera, the trust program is done under the monitoring program. Those things, I think, are generic. It's just that when we got down into all of these references, we don't have the experience for the other type of reactors. So that's why that caveat is up at the beginning.

MEMBER CORRADINI: So let me ask a last question, and then I'll wait for the industry's reaction to this. So at least as we sit now, there is no issue for this sort of long-term cooling that would have BWRs starting, BWR licensees, excuse me, to worry about this. So from a completeness standpoint, is it that there would be just, they would essentially not need to show long-term cooling via this what I'll call 50.46(e) approach? They would essentially show that their debris loading is such that they don't have an issue? Because now it's part of the rule.

MR. SMITH: That's right. They would use deterministic methods to determine their licensing basis.

MEMBER CORRADINI: Okay. And their licensing basis is not 15 grams per assembly.

MR. SMITH: No. Well, some PWRs, which this could apply to them if they chose, do have 15 grams per fuel assembly as their licensing basis. They have adopted that.

MEMBER CORRADINI: Okay, okay, all right, all right. Thank you.

MEMBER BLEY: I'd just toss in one comment. A lot of what John discussed, I think,

Steve, I went back and read the regulatory position part again, and I think they're probably covered. But what strikes me is being less than specific in Appendix B. It seems to me this kind of puts you in a spot where you're much more likely, when you review any applications of this type, to end up with a lot more RAIs and a more extended review process and some dissatisfaction on both sides, and I think clarity could really help in that area.

MEMBER STETKAR: Let me go back to the topic of uncertainty. I said I wasn't going to let it die. If I read Section B.2 about impact of debris, it says that, basically, I have a pass/fail criterion. If the assessed amount of debris on the strainers is more than X, I fail. If it's less than X, I pass.

It says these threshold values are derived from testing that demonstrates that long-term cooling will be maintained under those debris loads. Well, I'm now not a deterministic expert on this testing or the analyses. I've sat in on a bunch of subcommittees that have discussed those issues, and, to me, there seems to be reasonable amounts of uncertainty about that threshold value and, yet, this is simply a pass/fail.

So then I go and look at things that say, well, we accept methods in Reg Guide 1.82 because they're considered to be adequately conservative. So we're going to use those as our so-called consensus models in the sense of NUREG-1855.

Now, the interesting thing, it says the NRC considers the accepted deterministic methods to be conservative enough to compensate for uncertainty. In addition, portions of the analyses using NRC staff-accepted deterministic methods do not require quantification of uncertainty model or parametric.

Well, I'm sorry, a consensus model, if I establish a consensus model, according to NUREG-1855, I don't need to account for model uncertainty. There's nothing in NUREG-1855 that says I don't have to account for parametric uncertainty within that parametric, within that consensus model. It just says I don't need to account for model uncertainty. That is the model that everybody agrees is the good model.

If there's huge variability in the parametric portion of that model, huge uncertainty, NUREG-1855 doesn't give me a pass on that part of

the analysis. So I'll say to comply with the guidance in NUREG-1855 -- I'm sorry. We don't comply with guidance. To follow the guidance in NUREG-1855, I'm led to believe that even if I have a consensus model, I have to account for at least parametric uncertainty within that consensus model. This tells me I don't need to do that. I'm curious about that. So why is that?

MR. FONG: I think, I'm thinking of the consensus models that were, that we've seen so far, and they tend to deal, they're derived largely from deterministic calculations. For example, the zone of influence is a sphere with a certain set diameter.

I'm struggling to think of what parameter you would bury in those models.

MEMBER STETKAR: I'm talking about amounts and types of debris and transport of that debris and deposition of that debris and the effects of chemicals and particulates and fibers in that debris. Those are parameters in these models.

MR. FONG: And they're pegged high for this --

MEMBER STETKAR: How do you know that they're pegged high? They can't get any worse? Do

you know that? Or is there some information -- this gets back to where I'm eventually going to close the loop here. This gets back to what Dana is talking about. Do we know that it can't be any worse than what's in those calculations, or are they, as is characterized here, conservative enough?

MR. SMITH: When we, when we wrote this Reg Guide we didn't think it would be appropriate to create a higher or a more conservative model for the people implementing the risk-informed methodology than those implementing the deterministic methodology which we have accepted in the past.

MEMBER STETKAR: And I don't care what you've accepted in the past. I'm talking about now a risk-informed decision making process. I'm not advocating a more conservative model, I'm advocating the examination and consideration of uncertainties within that model that's been used. And not uncertainties regarding that model versus somebody else's model because I'm going to give you the fact that we have a consensus model. But there are parametric uncertainties in terms of quantities of debris generated.

Given that established spherical zone of influence there is uncertainties about the transport of that debris, the timing of the transport of the debris, the types of the debris and how the debris affects either the strainers or anything downstream from the strainers.

MR. SMITH: There is a lot of uncertainty. And, you know, we've studied these, these phenomena for years. And there's still a lot of uncertainty. And, you know, and the cost to eliminate or reduce the uncertainty has not, you know, we just haven't seen the need to do that because of the way we have implemented the deterministic model.

MEMBER STETKAR: And don't get me wrong, I don't care what the deterministic people have done, they have to live with and the staff has to live with what they've done. I'm now talking about these applications.

If we admit that there is a lot of uncertainty we ought to address that in a risk-informed decision making process. In other words, we talk about in the risk-informed decision making process, do I meet my safety margins? Well, it sounds like it's a strict pass/fail. It's either

black or white. I'm either absolutely above the line or I'm absolutely below the line.

The uncertainty might tell us, well, you know, there's a 3 percent chance that I'm above the line but I'm willing to accept that. Or a 7 percent chance or a 73 percent chance if it's a really strange looking distribution. And if I take that approach, it can address, I think, I hope, some of Dana's concerns about the unknown unknowns. How big could they be? And have I thought about them in this concept of looking at the uncertainty in my available safety margins.

And I don't see any of that type of discussion other than, well, you have to have an uncertainty distribution for the LOCA frequency. No, it's just part of the calculation and it may be the smallest uncertainty for all I know.

MR. SMITH: Yeah, but the safety margins are really in addition to, you know, the delta CDF. And it's another thing, the defense in depth is on top of what we're calculating as a potential failure. The safety margins are what we base our failure on.

So if we say that the structural failure's going to occur at 10 psi, that was

calculated using an ASME code. It's probably going to fail at 20 psi. So that's a safety margin. I mean, I think the safety margins, there's none of those lost in the methodology we use here.

MEMBER STETKAR: Probably should have not used the term "safety margins" because I, I'm not an attorney. Let me just use the term a risk-informed decision about whether or not my plant is acceptable. Even the term "acceptable" might get me in terms, in trouble with an attorney.

I'm trying to make a point here that when making decisions on a risk, based on a risk-informed approach. And those decisions are being made by people, the staff, the Commission, that this plant is either safe enough given what we understand about its debris, or it needs to do something to address debris under certain conditions.

And without an evaluation of all of the uncertainties, and I'm not necessarily talking about a detailed quantitative evaluation of every parametric uncertainty, but at least examining those. And maybe you can quantify them, providing that information so a decision maker says, well, yeah, you know there's a 97 percent chance that we

meet the acceptance criterion. And, you know, a 3 percent chance or some small chance based on some sort of qualitative evaluation of uncertainty that we don't. But I'm willing to accept that risk.

There's no discussion in here about that type of uncertainty evaluation, especially with regard to what you guys are calling the deterministic part of the calculation.

MR. GIITTER: Dr. Stetkar, let me just add I think what the staff is trying to do here is to come up with a methodology that can be easily applied. Granted it's not perfect. But, you know, our measure is reasonable terms of adequate protection, not absolute assurance.

And, you know, you have to strike a balance between the degree of effort and complexity that goes into something versus something that can be used and usable. And I think what the staff did is they tried to account for the major areas of uncertainty. And we took a conservative approach, granted. It may not have accounted for all the uncertainties but, you know, given that what we're trying to do here is to come up with a method that's reasonable and relatively reasonable to use and it will allow the staff to make a decision

without a lot of effort on our part or on the part of the licensee. I think it's a reasonable balance.

MEMBER STETKAR: I'm just going to let that stay on the record because it's on the record.

Without assessing uncertainties, people have made really bad decisions in the past.

CHAIRMAN BALLINGER: More questions?

MEMBER STETKAR: I do, on different topics. I don't know if anybody else wants to talk about uncertainty.

But that's my whole point was if we're following the guidance in Reg Guide 1.174, that guidance says that in a risk-informed approach I should consider it and evaluate uncertainties. And that evaluation of uncertainties as part of a decision making process isn't just the uncertainty in the LOCA frequency. With some sort of assertion that everything else is so conservative that it doesn't, the uncertainty doesn't matter, especially if I know there are large uncertainties and that everything else.

Okay. Now, different topic. Scope of the analyses. Is this process intended to only address debris generated by only LOCAs?

MR. FONG: No.

MEMBER STETKAR: Okay, I'm glad to hear that because there's so much discussion of LOCA frequencies and what LOCA frequency I should use and what LOCA scenarios I should develop, I kind of lost that. So is the staff's expectation, for example, in a pressurized water reactor that I should look at all transient events that can lead to feed and bleed cooling, for example?

MR. FONG: Well, I think our expectation is that LOCAs would probably contribute the most. But any --

MEMBER STETKAR: What? Wait, wait. I'll stop you right there.

MR. FONG: Okay.

MEMBER STETKAR: Because you're making an assertion. How do you know that?

MR. LAUR: Well, I guess the real answer is yes. If you look at, if you look at Section C of the Reg Guide that's how it starts out.

MEMBER STETKAR: It does start out that way.

MR. LAUR: Well, no, and there's an interesting little transition sentence in there

somewhere that says because LOCAs are, as C.J. mentioned, are, you know, it's not that they're necessarily dominant -- it turns out that they are based on the pilot -- but because they're problematic in terms of having to assign frequencies, all these things we've been talking about that we removed from Appendix C.

MEMBER STETKAR: Steve, I looked up my notes in a meeting that we had with the pilot, and I actually asked them, Gee, have you thought about debris that could be generated when the ruptured disk on the pressurizer relief tank blows after a feed and bleed cooling scenario?

He said, Gee, no, we haven't thought about that. We'll get back to you.

I asked him, Have you thought about the amount of debris that could be generated by a steam liner feedwater line break that would then devolve into a feed and bleed cooling scenario? Maybe not so important for their 3-train plant, but a lot more important for a 2-train plant.

They said, No, we haven't thought about that. But the steam line breaks aren't very important to us.

So I'm not sure how the pilot study has

addressed those because they told me they hadn't.

MR. LAUR: Well, okay, but they have. See, because of your excellent question when we got the license renewal request they not only considered those --

MEMBER STETKAR: Oh good.

MR. LAUR: -- but they had a very -- in fact you'll see a screening in the Reg Guide that was generated as a result of what the screen they used -- but in fact if you look at our RAIs, we have some beta seismic event, with a seismic event and that dislodged insulation.

MEMBER STETKAR: You're one step ahead of me.

MR. LAUR: Some plants, yeah, we'll steam line, feed line this into our licensing basis. We said, that's not how we do this.

So, yes, it's everything. But they're allowed, and the Reg Guide says it's allowed up front to do screening, just as the standard allows.

MEMBER STETKAR: But you're not allowed to screen on frequency of LOCA. You have to consider every LOCA, even if the frequency is 10 to the minus 18th because of the way you've partitioned it down, down to locations.

You're not allowed to screen on frequency of LOCA. That's clearly said up front. But apparently you're allowed to screen on frequency of these other things?

MR. LAUR: Well, if it's the whole plant. The LOCA being location-specific. That's why we put that specific --

MR. FONG: Caveat.

MR. LAUR: -- caveat in there about the LOCAs because we don't want things slicing and dicing so fine that they're all below truncation or something like that.

But the, but no, the answer to the seismic question, which I thought would be some sort of one-paragraph response, turned out being for fragilities and --

MEMBER STETKAR: Well, no, I mean the seismic stuff is a lot more interesting, if we want to start talking about that, because it's part of, it's part of my three or four questions on the scope of the evaluation.

The seismic stuff, when I read the guidance, leads me to believe that I need to look at seismic-induced failures of reactor coolant system stuff, seismic-induced LOCAs. Seismic

events are kind of interesting because the conditional likelihood of requiring feed and bleed cooling after a seismic event, given that I don't have offsite power, given that I don't have main feedwater, and I don't know what else is going on, diesels might have failed and things like that, could be relatively high.

Now, that isn't a seismic-induced break of any piece of piping.

MR. LAUR: Right.

MEMBER STETKAR: Nothing I saw. Okay.

However, lower acceleration seismic events, much lower accelerations than might fail any of the piping in a plant, might dislodge a whole lot of stuff inside the containment.

MR. LAUR: Right. We asked that question. And I think the answer was no.

MEMBER STETKAR: It won't? Okay.

MEMBER BLEY: No for the plants you asked about?

MR. LAUR: Sorry?

MEMBER BLEY: No for the plant you asked about.

MR. LAUR: Right.

MEMBER BLEY: Yes.

MR. LAUR: Specifically each plant's going to have to go -- that's why the thing starts out with identifying all scenarios for which recirculation could be a mitigating act or failure.

MR. SMITH: Specifically for debris generated by a seismic event, a lot could be generated but it would not be generated in the form that would result in transport and head loss of the strainer. It's going to come off in big pieces.

MEMBER BLEY: Do we know that for sure?

MEMBER STETKAR: Do we know that?

MR. SMITH: I, well, I guess you could project there's not going to be a lot of -- I think you could do a study on that and --

MEMBER STETKAR: Dust and dirt?

MR. SMITH: Well, there would be a lot of dust and dirt. But that, that's a very small amount of debris compared to what's generated by a LOCA.

MEMBER BLEY: But your hunks are falling 50, 80, 100 feet.

MR. SMITH: Yeah. They're --

MEMBER BLEY: They won't be hunks.

MR. SMITH: It's like a pillow falling. That's how the -- only much tougher. That's these

--

MR. LAUR: But also subsequent LOCA or the feed and bleed, you don't have anything to wash it there anyway.

MEMBER BLEY: Sure. You're got to get to a research scenario. But as Don's saying --

MR. LAUR: I'm talking the research scenario which is --

MEMBER BLEY: -- the seismic event is going to be, we suspect, more likely to get you to a feed and bleed --

MR. LAUR: Yeah, you're right.

MEMBER POWERS: In the aftermath of the limited set of earthquakes that I've experienced, everything is covered with dust.

MR. LAUR: Yeah.

(Simultaneous speaking.)

CHAIRMAN BALLINGER: A LOCA is a local event, one break so to speak. But a seismic event shakes the daylights out of everything. So I'm just wondering whether this dust might be a little more than dust.

MEMBER POWERS: Yeah.

CHAIRMAN BALLINGER: And might be a lot more than a little.

MEMBER STETKAR: The concern I had is that when we talk about -- and you're going to eventually get me to the site-specific part of the thing -- but the site-specific stuff talks about direct and indirect seismically-induced LOCAs. That's all it talks about. It doesn't talk about any of this other stuff. I couldn't find it. I was looking for it on here.

MR. LAUR: Their stuff I think is in C.1.

MR. FONG: We have four criteria for including a particular scenario in the analysis: generates debris, transports debris, live on recirculation, and wouldn't otherwise be a core damage event. And I think those four capture --

MEMBER STETKAR: That's good as long as applicants understand the expectation of what they need to look at. Because as I said, the vast majority of this guidance -- and I didn't do a word count -- focuses on LOCAs, LOCAs, LOCAs, LOCAs.

And the problem is that if a staff reviewer looks at the guidance and it says LOCAs, LOCAs, LOCAs, LOCAs, and an applicant comes in and says LOCAs, LOCAs, LOCAs, LOCAs, it's not at all clear that we're meeting the expectation, that

broader expectation -- and I like those four up in C -- the broader expectations of the entire assessment.

Or, if a staff reviewer looks at that and says, Hey, wait a minute. You didn't tell me about 10 to the minus, you know, 3 seismic events that might require feed and bleed cooling with recirculation, and you haven't assessed the amount of debris that would be available during that. An applicant will say, Well, we didn't interpret the guidance that way because all it says was seismic LOCA, seismic LOCA, direct or indirect.

CHAIRMAN BALLINGER: So you're arguing for stronger words?

MEMBER STETKAR: I'm arguing for a clarity in the regulatory guidance such that people who are going to perform assessments according to this regulatory guidance can submit them to the staff for review. And the staff reviewers who are going to use this regulatory guidance to look at those applications are on the same page in terms of understanding the scope of what they need to look at.

MR. FONG: I think we have pretty good language. I'm certainly open for improvements but

I mean we say up front that the systematic risk assessment should consider all hazards, initiating events and plant operating modes. It should not be limited to design-basis accidents, licensing-basis events, specific plant operating modes, or specific initiating events such as LOCA.

MEMBER STETKAR: Right.

MR. FONG: I mean we did say that up front, you can't just limit it to LOCA or design basis.

MEMBER STETKAR: It says -- that's, that's, C.J., I agree that the introduction stuff up front says all of that stuff. But then you get into things like screening. And the screening, other than telling me that I can't screen out LOCAs based on frequency, doesn't tell me much about what else I can screen out or how I can screen that stuff out.

So I could easily walk myself, as an applicant, into screening out all of those transients because everybody knows that LOCAs are only, the only important thing, and screening out seismic events that can result in transients other than a LOCA, because the seismic, the site-specific seismic guidance in here points me to seismically-

induced LOCAs.

So, okay, I'll worry about seismically-induced LOCAs and say they're small in frequency compared to the other stuff or whatever that may be.

MR. LAUR: Well, we've referred to the standard, and I thought we referred to 1855 for some reason, because I didn't look into that as much as you did. But we refer to the standard, it's the standard -- standard -- it's the typical PRA screening as set forth in the standard and the guidance in NUREG-1855.

So we, I guess we could have repeated it here but. And I would hope our reviewers, well, I mean if you look at the RAIs, if you ask a pilot plant, this was one of the topics. I mean we -- although they did submit an original submittal had here's all the initiating events we thought about and here's how we screened them. That's where we got those four bullets basically.

And we said, Well, what about seismic? And I forget what else we asked. But so.

MEMBER STETKAR: Well, if you think -- again, I read this as a someone who would like to take this guidance and do the absolute minimum

possible to satisfy an NRC staff review. And I, I tried to read the guidance to say what could I not do?

And I will agree that a strict interpretation of the introductory material in Section C would tell me that I can't get away with a lot. But I will tell you that most of the guidance seems to indicate that I can get away with quite a bit.

MR. LAUR: That's a good, good insight for us.

MEMBER STETKAR: So that all I'm saying is that in the guidance there's a lot of discussion of how one might do things. And, for example, in the site-specific seismic stuff there could be similar, just anecdotal guidance about don't forget to consider these types of things. You know, or our expectation is that you will consider these types of things.

Whether that goes in the screening part or whether that goes in the site-specific part, because a lot of these things are site-specific obviously, the whole thing is site-specific.

Just so it's real clear what the expectations are so that I'm as much concerned

about a staff reviewer, after somebody's done a reasonable amount of analysis, bringing up these issues and, as Dennis said, initiating a long litany of RAIs that could extend into fairly substantial discussions, if not re-analysis, as I am that neither party, neither the applicant nor the reviewer thinks about these other issues.

MR. FONG: This is something we thought about quite a bit. And, in fact, this was an early public comment. We got a public comment saying, Hey, can't we just limit this to Mode-1 and LOCAs?

We said, no, it's all Modes, it's all hazards. For a specific plant if you do an analysis and show that the key driver is Mode-1 LOCAs, fine. But it's up to the licensee to make that argument.

So this is certainly a very good issue and something that's come up before. And I think we've been pretty clear about what we want licensees to do. And we can certainly go back and see if there is some additional clarity to add throughout the guidance, but.

MEMBER BLEY: My impression is a bit like John's. But I see you have the right words in various places, but especially when you get back to

the appendices, the focus is all there.

And for this concern we've had for many years that began with a steam rupture experience in another country, to not make it maybe more clear. The shift from the introductory discussion to the here's how we do it, really is where I see it slipping to heavy emphasis on LOCAs, although it does happen to both to some extent.

And 1855 is cited in the main body a few times in kind of general ways. Of course where it shows up in the appendices is just on the pipe ruptures, I believe.

CHAIRMAN BALLINGER: Next question?

MEMBER STETKAR: Actually, in the interest of time, I don't -- I mean I have a lot but I don't have any more -- those are the big ones that I wanted to get on the record.

CHAIRMAN BALLINGER: Well, in the true spirit of an MIT faculty meeting, we have used up all the available time in spite of the fact that we've nominally finished early on this. Can we, I think we should take a break for, till 25 of. And then for the next -- if that's okay.

We'll adjourn.

(Whereupon, the above-entitled matter

went off the record at 10:20 a.m. and resumed at 10:39 a.m.)

CHAIRMAN BALLINGER: Okay, we're back in session.

Next up is the industry presentation.

MR. GEIER: Good morning. I'm Steve Geier and I'm with NEI. And we're here to talk about their industry perspective on the draft Reg Guide.

And I'm just going to give some introductory remarks and then turn it over to really the industry experts. We have Larry Naron here from Exelon for the BWR perspective and kind of overall; and then Wayne Harrison from STP, the pilot, the pilot plant.

And basically, you know, from the NEI perspective, you know, when we look at a Reg Guide such as this we really want to ensure the information is provided to make sure it can be officially implemented without having the substantial consumption of resources. Really looking at efficiency here and effectiveness.

And we also want to make sure that it's appropriately written so that it will assist, assist the plant or at least not impact on the

ability to close the issues and address the issues that they're using this, this risk-informed approach for.

And then just over all just a reemphasis, you know, on the efficiency standpoint is the industry does have several initiatives under way to ensure that we could be cost-effectively moving forward in resolving these issues implementing the regulatory guidance, such as cumulative effects of regulation, of course the NRC's own program Project Aim 2020, and then NEI's Delivering Nuclear Promise. We have several initiatives under way just looking at being as efficient as possible with the limited resources we have so that the plants can continue to be competitive, continue to be operating safely and reliably.

And with that I will turn it over to Larry Naron to give the industry perspective.

MR. NARON: Good morning, everybody. Thanks for having us here.

It has been an interesting discussion so far. And actually, a lot of the, a lot of the points I wanted to make have already been made. This slide, for instance, was just discussed. So I

thought that that was a good discussion. Don't really have anything to add to that.

Although we didn't -- we touched on new plants a little bit in the discussion, but that, wanted to make sure that we brought that up that, you know, that may be interesting in new plants evolving for instance to use this approach.

Next slide.

MEMBER REMPE: Well, it was discussed. I think Professor Corradini mentioned that it doesn't address this. But since you're from the BWR industry what would you like to see done here?

MR. NARON: Well, what we looked at in reviewing this and from the BWR side was this guidance, did it preclude us from doing anything? Was it -- would we be able to take the guidance and would it help us to approach a risk-informed resolution for this if we chose. And we didn't see anything that precluded us from doing it. Although the question came up, I don't know of any BWRs right now that are intending to use this.

MEMBER REMPE: So you don't have any recommendations on what you would like to see done to improve it is what I'm hearing from you?

MR. NARON: You know, I'm going to touch

on a couple. But in general there's some improvements that, you know, we feel could be made based if we started down, say a pilot would be develop -- be doing more.

MEMBER REMPE: Okay.

MR. NARON: So next slide.

There are, there were some prescriptive portions of the Reg Guide. For instance, we discussed earlier, you know, break location, can you screen just low frequencies. And the frequencies being sort of prescriptively pointed toward the arithmetic mean rather than geometric mean.

There is wording in there that will allow you to justify it. But, again, that would create more interaction, more time and resources to justify using other than the arithmetic mean. I thought that was too prescriptive.

Next slide.

And then there was some parts of the Reg Guide that weren't very prescriptive. And the threshold for reporting defense in depth and safety margin changes, for instance, you know, it left for interpretation that any change, however small, would be reportable. And I don't think that was

the intent.

CHAIRMAN BALLINGER: That was a -- I think that was addressed at least nominally in the latest version; right? The reporting issues, the thresholds for reporting?

MR. NARON: It seemed still vague to me that I saw, if there was a change. I don't see it.

CHAIRMAN BALLINGER: Okay.

MR. W. HARRISON: And I would agree with what Larry is saying there. The threshold for reporting on defense in depth and safety margins, which are non-quantitative things that are being put in our application, I'm not sure if from a regulatory perspective how we would evaluate reporting degradation of defense in depth and safety margin with respect to, with respect to this.

Now, if we could, personally I would prefer to see, well, if you can quantify in some way an effect on the risk maybe that would be a better metric for use in reportability or doing report rather than these softer issues.

MR. NARON: And along the same lines, the 48-month update requirement that, having the requirement that's just calendar-driven rather

than, you know, what changes have been made that would warrant updating. Again, updates are costly and to have it just driven by time doesn't seem appropriate.

Next slide.

MEMBER STETKAR: I'm just curious. If it were time-driven and you hadn't made any substantive changes, what would be involved in that update?

MR. NARON: And that, that was another comment that it's not clear what, you know, what the scope of an update would require.

MEMBER STETKAR: Yeah. It strikes me if nothing changed the update is the original one.

MR. W. HARRISON: I think I agree with what Larry's saying there. We'd probably like to have more dialog on this.

Oh, thank you. I didn't realize we had a button to push there.

I said we would probably like to have more dialog from the staff on that reporting. South Texas currently has an update -- excuse me, it's not on reporting but on the updates -- South Texas currently has a requirement in our updated final safety analysis report for updating that was

based on our pilot exemption request that resembles the 50.69 special treatment requirements.

But if you read what's in the regulation for 50,69, it talks about updating as well but it doesn't have specific time limits for updating our requirements. So, you know, there's some, that was some precedent for that that we might refer back to.

MR. NARON: So there was a lot of discussion earlier about the inputs that are deterministic in nature such as strainer behavior, debris transport. And all of these I guess from our view introduces conservatism and it's cumulative. And the more that we add these conservatisms from the deterministic inputs, the further that we get away from realism.

So that's, that's a concern that we may be overstating the risk based on implementing the deterministic.

MEMBER STETKAR: Larry, let me pulse you on that because you've heard me talking about uncertainty and things like that. I, of course, in my comments was approaching the concept of uncertainty and not fully examining where those deterministic values are in the overall uncertainty

distribution so that you better understand margins that may be available using those values.

Are you advocating the use of uncertainties throughout those analyses so that you understand if they are conservative, how conservative they are? Or are you advocating using different values? And if so, what different values do you use?

MR. NARON: I think the way I view it is in order to get, you know, take those conservatisms out it would take a lot of effort, a lot. And in order to get closer to realism with these inputs would be very, very difficult and costly. So it's more of a recognition that the more the deterministic inputs, the more the trying to refine, it just increases the cost, increases the resource. And at a certain point it makes -- it's too complicated.

MEMBER STETKAR: Well, but I'm asking you what are you proposing as an alternative? I mean if you say, well, the deterministic inputs are too conservative and it requires a lot of effort to address the issue, given those deterministic inputs, what's the alternative? Do I use probabilistic inputs? And will that somehow

simplify the effort and reduce conservatism, which is your concern?

MR. NARON: And I guess this will come out of the pilot. I don't really come here with a fix, more of a recognition that there will have to be worked through in order for this to be a useful approach.

MR. W. HARRISON: I'll comment on this from a regulatory perspective.

The South Texas project started out with a detailed approach. And after a while we determined that we would probably be better, better served with a simplified approach would be done in basically about a year ago. And our simplified approach it isn't counting assessment, it's based on a successful test that we performed. And then any break that generates more debris than we passed in that -- in any more fibrous, fine fiber debris than we passed in that test we assume goes to failure. And then we apply NUREG-1829 break frequencies to determine what's the probability of generating that amount of debris that it sees what we tested.

So this is a, I would consider this a bounding risk assessment. We don't use our PRA

model to do this. We -- Laur talked about that. We, again, we look at how much debris is generated and what's the break size that generates that much debris, and applied NUREG-1829 to determine what that, what that is. That's our application of our PRA. Basically the only thing we're using our PRA for is to compare that risk to the -- our baseline risk in our PRA to see what region we are in Reg Guide 1.174.

So, we talked about do we intend to change the base PRA for this? And our purpose in doing this was to respond to generic letter 2004-02 and assess the impact of risk on STP and to close that generic letter. And that was also part of this focus as a Reg Guide.

So we know, so we came up with a satisfactory calculation of risk which puts us in Region III. We used the geometric mean to do that. We're in Region II with the arithmetic mean. But we would not propose to change our base PRA.

And I think we talked about, this was discussed at some length a little bit ago. From a regulatory perspective and licensing perspective I don't, I look at this as a PRA calculation. But what we will do is put this process and this model

and the assumptions that went into this evaluation into our updated final safety analysis report. So it's part of our licensing basis now, along with the exemptions that went along with it and the evaluation that was performed by the NRC.

So if we make a change to the plant, then we have to go back and look at what did we change in the UFSAR and are we still aligned, aligned with that. So it's not that we go back and look necessarily at the "PRA" and re-do the base PRA. We have to look and see how did we affect our licensing basis?

They may require us to go back and do some eval, PRA evaluations. But fundamentally it's how did we affect the licensing basis that we just implemented?

MEMBER SKILLMAN: Wayne, let me ask you to back up a slide, please, to six.

I think I understood what you just said. With the, with your SER the way it's written and with your PRA count with the GSI-191 subcount, if you'd like to call it that.

MR. W. HARRISON: Uh-huh.

MEMBER SKILLMAN: Do you have difficulty with reporting, which is C.8 of this.

MR. W. HARRISON: Let me look at C.8.

MEMBER SKILLMAN: Yeah.

MR. W. HARRISON: Read it.

MEMBER SKILLMAN: I would think based on what you said, any change that you might find is pretty much the same process at your plant as you would have if you found a condition for which reporting was required. If you found yourself in a tech spec situation or you found yourself in an operability determination and said, Hey, we better -- we've got a 5072, a 5072 report, I know that you're people do that --

MR. W. HARRISON: That's correct.

MR. SKILLMAN: -- regularly. That's not an issue. Why wouldn't that be the same for this?

MR. W. HARRISON: We have in our application a proposed change to the technical specifications that have for emergency core coolant system and containment spray a debris-specific action for, well, a debris-specific action that if we identify a condition where there is more debris than what was evaluated in, in what we evaluated in this -- or in this analysis --

MEMBER SKILLMAN: The assumptions for

those analyses.

MR. W. HARRISON: -- assumptions for those analyses, then we would be in a -- we would enter our technical specification.

And then we would follow our corrective action program and reporting process to determine, well, is that a reportable condition? How long were we there? Was it really inoperable? Do I have, do I have margins in my safety margins that account for that?

There's a, you know, there's a process that we accepted for doing that reportability for the effect of that debris.

MEMBER SKILLMAN: So it sounds like at least for your plant the proposed change to C.8 is of no real significance. That's not an increase in work; you would be doing that anyways?

MR. W. HARRISON: Well, I think what I was talking about back on C.8 is I'm not sure how in that process that we would address reduction in defense in depth or safety margin. Because that's not a -- that's a softer issue to address. I mean because it involves other, other equipment, maybe non-safety related equipment. And how long was that? And how does that really affect my safety

margin? Does it make a significant effect?

I don't -- that's a new area for us to go into. We really haven't had much experience doing this.

MEMBER SKILLMAN: What I hear you saying is you're good with the concept of reporting. The difficulty is the metrics specifically for defense in depth and safety margin. It's the metrics that would cause you --

MR. W. HARRISON: Yes, sir, that's correct. That's a good way to say that.

MEMBER SKILLMAN: Okay, thank you. That helps. Thanks.

MR. W. HARRISON: And on the comments that I was making about the UFSAR and the licensing basis and the question on -- to me, that's a different question than what I would expect to see in the Regulatory Guide. I would not have expected C.J. to put that direction or that explanation in this regulatory guide. That's a different area.

MR. NARON: Okay, let's turn to the last slide now.

So in conclusion, you know, I pointed out some areas that could be enhanced, like the, feel like the Reg Guide when we looked at it from

the plants, the pilot plants and some others that are looking at using this, we had them review it. And they felt that the guidance was useful and acceptable and could, they could continue the way they were going without any changes to the Reg Guide. Although it is, as we've discussed, kind of narrow in scope. It's focused on Reg Guide 191 for PWRs, existing PWRs.

And the other point that we discussed is that in allowing for flexibility it also would, could result in many different approaches which would take many, you know, more time to review and more resources on both sides, both staff and utility.

MR. W. HARRISON: From the pilot plant's perspective I agree with what Larry is saying. Our pilot application, the content of our pilot application lines up pretty well with what's in the Regulatory Guide. I think it does establish a process structure for the licensees and the staff to follow.

There was a lot of dialog from the ACRS subcommittee itself with respect to the specific requirements in that Regulatory Guide. And I would anticipate those same, that same kind of dialog to

occur between the licensee and the staff in the implementation of that. So that doesn't -- we still need to resolve a number of those things, which will probably be done on that basis. But it still has us, I would say that it still has us talking about the right things to get us to where we need to be.

MR. NARON: Yeah, and I don't want to not recognize that the staff has worked with us in, you know, in creating this. And the pilot process is working. And the interaction we've had with the staff has been very constructive. And we would expect that to continue.

CHAIRMAN BALLINGER: Questions?

Can we get -- I understand that there are at least four people on the public line. So while we're waiting -- Oh, excuse me. Corradini first.

Is there anybody in the audience who would like to make a statement?

(No response.)

CHAIRMAN BALLINGER: Hearing none.

Are you there yet, Mike?

MEMBER CORRADINI: No. I just sent you a note.

CHAIRMAN BALLINGER: Just sent me a note. You're talking.

MEMBER CORRADINI: Okay. You didn't acknowledge.

Let me ask the industry folks a question. So when I asked the staff about Appendix C and the fact that they had two additional things they were looking at which would be completed by the end of the calendar year, is it your feeling that some of the licensees want to move forward now and then wait on the Reg Guide to, what I'll say, give more realistic, realistic analysis, and Appendix C is not necessary and you want to move on this and get it published now?

What is the industry's view on that?

MR. W. HARRISON: This is Wayne Harrison speaking.

You know, we're the pilot and we're not depending upon the Reg Guide for our application. So I don't know that I can speak for the rest of the industry.

At some point I think there will be some other plants following on that need to refer to the Regulatory Guide. And I'm not sure when those, those applications will follow, whether they

will follow after the rule or after the STP application is approved.

So schedule-wise, I see it's to their benefit to have a Regulatory Guide, to have more clarity. Besides the STP docketed information and the staff's safety evaluation I think, you know, the Reg Guide does provide an outline for that. So there is an advantage to having that in front of them as well.

MEMBER CORRADINI: Sure.

MR. W. HARRISON: But that's all I could say schedule-wise.

MEMBER CORRADINI: Well, what I'm interpreting you to say is sooner than -- sooner rather than later is good for industry at this point, even though there will be modifications to the Reg Guide?

MR. W. HARRISON: Yes, I think so.

MEMBER CORRADINI: Okay, thank you.

MR. GEIER: This is Steve Geier from NEI. Just to, you know, make a quick comment.

Gaining industry comments on this process I think, as you said, their being, they're the pilot and some of the plants are looking to follow on after that. But from an urgency

standpoint, you know, we don't know of anybody that's waiting for additional guidance to really kind of fall into line behind the pilot project.

MR. W. HARRISON: I believe that's correct.

MR. GEIER: So again, sooner rather than later but, you know, it's not -- I think it's worthwhile to put this out on the street and then have the remainder follow up on that later this year.

CHAIRMAN BALLINGER: Okay, is the other line open? If you're, if anybody is out there on the line would you please identify yourself.

MR. KEY: This is Ernie Key. I'm representing the public.

And I just want to mention I have been involved for some time on this problem, as some of you know. And one observation I'd like to kind of throw out because there's a lot of discussion about the relationship to the PRA of the risk that is evaluated -- and this is all in the public domain from the GSI-191 effort itself -- is that it's -- the right way to think about what we call the risk would be an initiating event frequency as opposed to a, you know, like a basic event that shows up at

the PRA.

That's the way the recent application is devised.

Then, secondly, there was a lot of discussion about uncertainty quantification. And we get that. And, again, as Wayne mentioned, we've attacked this from two perspectives. And we in the first approach had included large uncertainties, really long-tailed ones on several parameters. And we sampled those very carefully.

And I don't believe -- this is just my personal observation -- I don't believe that doing that exercise was as helpful as actually disclosing, looking at scenarios that you get out of the risk analysis. So South Texas looked at some scenarios that were informative. And others have found the same value.

So I think actually this, an approach that's not a classical uncertainty approach but is more along the lines of a classic probabilistic risk assessment approach where you tease out scenarios is helpful. And I don't think that's lost in anything in this Reg Guide.

And then, finally, there was discussion as to inclusion of the risk assessment in the PRA

and how was that updated. And what we've found is that even with a simplified approach the magnitude of the risk is on the order or 10 to the minus 7. And in the more detailed approach it's even lower, like 10 to the minus 8.

So really the -- with a typical PRA CDF estimate of 10 to the minus 5th, this is very, very small compared to that.

So anyway, I think the risk analysis is capable, the way the Reg Guide is written, of revealing some weaknesses in the design. And we can -- and it's helpful in that regard.

Thank you.

CHAIRMAN BALLINGER: Thank you.

Anybody else out there?

(No response.)

Going once, twice. Done.

Thank you. Can we close that line?

MR. BLOSSOM: I've got a question. Should we correct the record? I mean Ernie's reading --

CHAIRMAN BALLINGER: Can you tell us who you are?

MR. BLOSSOM: Pardon me?

CHAIRMAN BALLINGER: Who are you?

MR. BLOSSOM: Steve Blossom from South Texas.

CHAIRMAN BALLINGER: Get a little closer to your mike, sir.

MR. BLOSSOM: I was curious whether we should correct the record. Ernie's discussion, he's really not representing the public, he's representing industry. He might have called the wrong number or something like that, but he's, I don't know protocol-wise whether we should do that or it doesn't matter?

CHAIRMAN BALLINGER: It's on the record now.

MEMBER STETKAR: It's done.

(Laughter.)

MEMBER STETKAR: You will see that in writing, verbatim.

CHAIRMAN BALLINGER: Okay, so the line is closed. Can we go around the table and get comments from members, particular recommendations with respect to going forward? Dick?

MEMBER SKILLMAN: Yeah. I, let me be careful what I say here. I'm impressed at what I heard today.

What strikes me is, particularly from

Steve Laur and from C.J. Fong, they were very clear in saying, hey, recognize that this is, this Reg Guide is pointing to a tool to quantify the risk simply of one little piece of GSI-191. It's the incremental risk from a break at a certain location for debris. It's not, this is not an all-encompassing, this Reg Guide is not intended to be an all-encompassing quantification tool. It's very surgically focused.

And once I began to understand that that's what those two gentleman were communicating I said to myself, okay, now this is like a small slide rule, a small piece looking at one very, very small segment of the overall PRA topic.

And so perhaps as we consider where we're going to go in the full meeting, if we can somehow make sure that the extent of applicability to what these changes mean and the instructions for how to make those changes from this Reg Guide, I would find that very helpful. Speaking as one member of the subcommittee.

Thank you.

CHAIRMAN BALLINGER: Dana?

MEMBER POWERS: No comment.

CHAIRMAN BALLINGER: Dennis?

MEMBER BLEY: Yeah, just a couple things.

I'm not as happy as I would have hoped I'd be at this point. It's cleaned up a lot since what we saw back in December; so I'm glad we waited to look at this.

I kind of, I see where the staff points up in the main body the caveats and things that are important. I think the lack of specificity in the appendices is going to make the review process tougher. I would hope at some point they would revise this document to include that. I don't know that I would really push that it be done at this point.

As they work on the alternative methods for Appendix C, I trust they will remember the discussions we had back in December. We haven't looked at that in a long time. And take advantage of what was said at that time.

Otherwise that's all.

CHAIRMAN BALLINGER: John.

MEMBER STETKAR: Yeah. I asked a lot of questions and made a lot of statements. I kind of to tie things together would like to sort of summarize the three major points that I had.

The first one, and I'll echo Dennis, is that I think that the Reg Guide suffers a bit from lack of clarity in terms of the expected scope of the assessments which would be performed. And I, you know, I gave the examples of bleed and feed, and steam line breaks, and we talked about seismic things. But making sure that both the applicant and the staff reviewers have a common understanding of the expectation of what should be addressed.

The second is this issue of "the PRA." And I will just use that term because in my simplistic mind there is "the PRA" for the plant, not 27 different PRAs. How, how would that PRA -- what's the expectation for how that PRA or the information in that PRA, or however you want to characterize it, be used to support the simplified analysis in Appendix B?

And again, the thing that we've talked about a couple of times is would, after the analysis is completed, whether it's a simplified analysis or a detailed analysis, would that evaluation then become part of the PRA going forward as an assessment of the risk from debris?

And then the third issue is this whole discussion about how uncertainty is treated beyond

just the uncertainty in the LOCA frequency, whichever, I don't care whether you use the arithmetic aggregation approach or the geometric mean aggregation approach, it's clear that I have to pluck some numbers for those frequencies.

But how is the uncertainty in the so-called deterministic consensus methods for debris generation, transport deposition, and phenomena addressed as part of the risk-informed decision making process? Either quantitatively or qualitatively, what sort of guidance is there for making sure that people also address the uncertainty in those so-called deterministic analyses?

So those are my three big ones.

CHAIRMAN BALLINGER: Joy.

MEMBER REMPE: I don't have any specific. Although there are a couple points that I did want to mention.

One, several of my colleagues during the discussion today there were several places where some additional clarification, and I believe the staff agreed that, well, maybe we could add those things in. I'd like to encourage the staff to do that and let us know that before the full

committee meeting or at the full committee meeting.

But I guess I'm most persuaded by industry saying, well, I mean we've talked today about, yeah, it could be improved upon, but yeah, go ahead and put it out on the street. Because that was my question, why don't you just wait because it doesn't sound like he was using it right away. But if industry thinks it might help and the staff have said, yeah, there's good stuff in this Reg Guide to go ahead and put it on out, I'm kind of persuaded, yeah, probably it should go ahead and be released. But I hope that is adjusted.

CHAIRMAN BALLINGER: Mike Corradini, are you still pliable up there? We're working on it.

MEMBER CORRADINI: Hello.

CHAIRMAN BALLINGER: Hello.

MEMBER CORRADINI: You can hear me now?

CHAIRMAN BALLINGER: Yes, we can.

MEMBER CORRADINI: Okay. So I guess I heard all the comments of the members. And Joy actually brought up the one about, I'll use the provocative way of saying it, I'm not sure what the rush is. I'm hearing that the guide is really probably not going to be used by the BWR community

because they don't, they don't have anything that needs to be solved at this point.

I'm hearing that on the PWR side, although it would be good to get it out now, staff is going through and is going to, I will say, put a more complete Appendix C out for consideration. And in that time period I'm not sure what's going to be used, what this will be used for. So I'm not sure what the rush is.

The other thing is -- and I thought Dana was going to bring it up -- I still sense that Dana is looking for a completeness discussion about what have we thought about and has been discarded just so at least for the moment we understand what's complete. And the one thing he mentioned was chemistry effects induced by radiation.

And I'm curious if the South Texas people have been asked that and considered it and then disposed of it. But I think the completeness part of this is missing.

So if staff and industry want to see this out on the street, that's fine. But I sense we're going to be back here talking about this again.

That's it for me.

CHAIRMAN BALLINGER: Thank you. That's actually a good lead-in because to sort of open the question to the staff is, is it time to go to the full committee? Given what you've heard so far and what would likely appear in a letter basically going to the full committee, is this the time to do that?

MR. FONG: That's our position, yes.

CHAIRMAN BALLINGER: Simple enough. Simple enough. Thank you. I guess --

MEMBER POWERS: It would be a relatively complicated letter to write. But I don't think there would be any -- I don't think it would be an impossible letter to write.

CHAIRMAN BALLINGER: Impossible -- Never mind.

Okay, thank you. With that I think, if there aren't any other questions or comments we are adjourned.

MEMBER BLEY: Let me speak on that. Oh, you already said it.

MEMBER POWERS: No, he didn't bang the gavel.

MEMBER BLEY: He didn't bang the gavel.

I would hope at a full committee

meeting the staff would explain to the full committee the issue Mike raised about what's the rush and why, why is it best to do it now in a little more detail that you have today.

MEMBER POWERS: It seems to me that a lot of the concern arose because you have South Texas being a pilot, which is a distinct plant with features peculiar to themselves. And you say, gee, how does this extrapolate on? Well, there's no better opportunity to find out how it extrapolates on than have other people use it.

So I mean I think that almost answers itself by saying, okay, we've got this thing. It's not as complete as we'd like but it's useful. And the only way we're going to know how to guide our further completion on this is to have more people use it.

MEMBER BLEY: I wouldn't disagree with that at all except nobody is standing in line.

MEMBER POWERS: I don't think so.

But maybe this is a peculiar opportunity that the staff has to actually be well ahead of the game here and to guide their subsequent work on the other alternatives, based on what they episodically learn.

MR. FONG: Can I add one comment to that, Mr. Chairman?

CHAIRMAN BALLINGER: Sure.

MR. FONG: There are several licensees in the queue, so to speak, to use this method. And we expect, based on a draft schedule I was provided, to review several of these in calendar year 2016. So that there are other licensees, not on the docket yet, but have told us, hey, we're coming in in 2016, we want to use the risk-informed method.

CHAIRMAN BALLINGER: But with regard to the advice to the staff for the full committee, should really go after these questions.

MR. FONG: Oh, of course. Absolutely.

And the other thing I'd add is that the Commission's expectation on, the policy I should say on the cumulative effects of regulation, guide the staff to release implementation guidance like Reg Guides for public use when the rule goes out. So we've got a Rule 5046c that's going to the Commission very soon.

CHAIRMAN BALLINGER: Has it gone up yet?

MR. FONG: Not with the Commission.

CHAIRMAN BALLINGER: Okay.

MR. FONG: It's now with SECY. And so we'd like to get the guidance necessary for folks to use that rule out on the street.

CHAIRMAN BALLINGER: Thank you.

Try number two. Okay, absent any other comments, we are adjourned until I think 1:00 o'clock. Oh, we're adjourned. There's another meeting going on.

So this subcommittee is adjourned.

(Whereupon, at 11:24 a.m., the subcommittee was adjourned.)

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Protecting People and the Environment

Regulatory Guide 1.229
Risk-Informed Approach for Addressing the Effects of Debris on Post-Accident Long-Term Core Cooling

Advisory Committee on Reactor Safeguards
March 22, 2016

Steve Laur, CJ Fong
Division of Risk Assessment
Steve Smith, Division of Safety Systems
Office of Nuclear Reactor Regulation

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Objectives

1. Provide status of RG
2. Describe changes made subsequent to November 4, 2015 subcommittee meeting
3. Clarify difference between detailed approach (Appendix A) and simplified approach (Appendix B)

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Status

- During November 2015 subcommittee meeting, RG 1.229 was still undergoing inter-office concurrence
- Substantive and editorial changes were made in response to feedback during concurrence process and minor changes to the rule itself
- Final concurrence and OGC no legal objection received on 2/8/2016
- Concurrence version of RG transmitted to ACRS subcommittee on 2/23/2016
- Staff believes RG is ready for use

Change to rule led to a minor change to the RG

(Discussed during February 4, 2016 full ACRS meeting)

- Rule language changed to clarify that *some (not all)* changes to methods require NRC approval
- Conforming change made to RG 1.229 Section C.9 requiring that the specific methods be identified

Insights gained from concurrence process

November 2015 version of RG 1.229 Appendix C contained three methods for allocating plant wide LOCA frequency onto specific break locations:

1. Bounding
2. Conservative Partitioning
3. Semi-Quantitative Partitioning

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Changes to Appendix C

- Methods 2 and 3 were removed due to comments received during concurrence
  - Deemed to “have merit” but not ready for regulatory use
- Version discussed during December 2015 full ACRS meeting retained only the bounding method (“method 1”)

Appendix C, Path Forward

- RG 1.229 is ready for use now (concurrence has been achieved)
- Bounding method in Appendix C is suitable for pilot based on staff confirmatory calculations
- Staff will evaluate pilot experience and revise RG 1.229
- Staff currently developing additional LOCA frequency allocation methods for revised RG

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Future revisions to Appendix C

- NRR, RES senior management met on 2/8/16; agreed to augment Appendix C with more realistic methods
- Project plan has been developed
- Key RES and NRR staff identified
- Target completion: late 2016 / early 2017

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Detailed Approach (Appendix A)

- New strainer/core failure basic events added to PRA model
- Phenomenological model to estimate failure probabilities for those basic events
  - Debris generation and transport
  - Impact on strainers and core
  - Considers scenario-based parameter differences

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Simplified Approach (Appendix B)

- "Go/no-go" debris threshold based on test
- LOCA sizes/locations compared to criteria
  - CCDP = 0.0 if debris generated & transported < threshold
  - CCDP = 1.0 otherwise

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Conclusion

- RG 1.229 has completed concurrence process
- RG relies on existing, proven framework (RG 1.174, RG 1.82, NEI-04-07)
- Staff believes RG ready for use (based on STP pilot)
- Staff is developing additional methods for use in a future version of Appendix C

Industry Perspective on Draft RG 1.229

Stephen Geier

Senior Project Manager, Nuclear Energy Institute

ACRS Subcommittee on Metallurgy and Reactor Fuels

MARCH 22, 2016

Rockville, MD

NEI Perspective

- Introductory Remarks
- Ensure information is provided for efficient implementation substantial consumption of resources
- Assist in resolution of issues affecting PWRs and BWRs
- Need exists to maximize efficient implementation in concert with programs focused on improving efficiency:
  - NEI ‘Cumulative Effects of Regulation Project’
  - NRC ‘Project AIM 2020’
  - NEI ‘Delivering the Nuclear Promise’

Industry Perspective on Draft RG 1.229

Larry Naron

Senior Manager-Exelon Risk Management
Vice Chairman-BWROG IRIR Committee

RISK-INFORMED APPROACH FOR ADDRESSING THE EFFECTS OF DEBRIS ON POSTACCIDENT LONG-TERM CORE COOLING

MARCH 22, 2016, ROCKVILLE, MD

Industry Perspective on Draft RG 1.229

High Level Generic Observations

- Introduction section notes the purpose is to present acceptable methods for addressing 10 CFR 50.46c "…effects of debris on long-term cooling"
- RG is almost exclusively tailored to resolving GSI-191 for existing PWR plants.
  - Silent on New Plants or BWR's

Industry Perspective on Draft RG 1.229

High Level Generic Observations

- RG is prescriptive in some areas -likely requiring significant interaction between the licensee and staff reviewers
  - C.1.b“…no break location or LOCA scenario should be screened from the analysis strictly due to its assumed low frequency of occurrence”
  - C.2.b“…NUREG -1829 frequencies determined using arithmetic or mixed distribution is acceptable”

Industry Perspective on Draft RG 1.229

High Level Generic Observations

- RG is vague in some areas -likely requiring significant interaction between the licensee and staff reviewers
  - C.7 Scope and content of required 48 month update
  - C.8 Threshold for reporting reduction of defense in depth or safety margin

Industry Perspective on Draft RG 1.229

Risk Informed Culture

- Use of deterministic input to risk informed regulation has been problematic
  - RG requires deterministic input such as strainer behavior, debris transport, and chemical effects
  - This likely introduces conservatisms which are cumulative

Industry Perspective on Draft RG 1.229

Conclusion

- Effectively describes two acceptable approaches to addressing debris
- Is useful in identifying salient focal areas for analysis
- Is somewhat narrow in scope
- Allows flexibility, but may result in varied approaches increasing preparation and review resources