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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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REGULATORY RULEMAKING, POLICIES AND PRACTICES

SUBCOMMITTEE

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THURSDAY

JANUARY 16, 2025

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The Subcommittee met via Video conference, at 8:30 a.m. EST, Ronald Ballinger, Chairman, presiding.

SUBCOMMITTEE MEMBERS:

RONALD G. BALLINGER, Chairman

GREGORY H. HALNON, Vice Chairman

VICKI M. BIER, Member

VESNA B. DIMITRIJEVIC, Member

CRAIG D. HARRINGTON, Member

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ROBERT P. MARTIN, Member

SCOTT P. PALMTAG, Member

DAVID A. PETTI, Member

THOMAS E. ROBERTS, Member

ACRS CONSULTANT:

DENNIS BLEY

STEVEN SCHULTZ

DESIGNATED FEDERAL OFFICIAL:

WEIDONG WANG

ALSO PRESENT:

VICTORIA ANDERSON, NEI

KEVIN BARBER, Westinghouse

LARRY BURKHART, ACRS/TSB

JONATHAN CHAVERS, Southern Nuclear

THERESA CLARK, NRR/DSS

PAUL CLIFFORD, Framatome

JAMES CORSON, RES/DSA/FSCB

AL CSONTOS, NEI

ELIJAH DICKSON, NRR/DRA/ARCB

LISA GERKEN, Framatome

SE-KWON JUNG, NRR/DEX

JEFF KOBELAK, Westinghouse

GUANGJUN LI, GE Hitachi Nuclear Energy

TARA MATHENY, Duke Energy

JOSEPH MESSINA, NRR/DSS/SFNB

BRIAN MOUNT, Dominion/PWROG

KURSHAD MUFTUOGLU, EPRI

CHARLEY PEABODY, NRR/DSS/SNSB
JASON PIOTTER, NMSS/DFM/NF
DAVID RUDLAND, NRR/DNRL
BARIS SARIKAYA, Constellation
FRED SMITH, EPRI
JIM STAVELY, PSEG
ROBERT TREGONING, RES/DE

A-G-E-N-D-A

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

8:30 a.m.

CHAIR BALLINGER: Good morning, the meeting will now come to order. And I think I'm getting feedback.

This is a meeting of the Regulatory Rulemaking, Policies and Practice Subcommittee of the Advisory Committee on Reactor Safeguards. I'm Ron Ballinger, the Chair of today's subcommittee meeting.

The ACRS members in attendance in person, myself, are Bob Martin, Tom Roberts, Craig Harrington, Greg Halnon, and Scott Palmtag. ACRS members in attendance virtually via Teams are Dave Petti, Walt Kirchner, Vicki Bier, and Vesna Dimitrijevic. I expect that Matt Sunseri will probably join us as well.

We have two consultants participating, Steve Schultz, and Dennis Bley, today. Dennis Bley is virtual. If I've missed anybody, I'm sure I'll get notice of that.

Weidong Wang from the ACRS staff is the designated federal officer for this meeting. No member conflicts of interest were identified for today's meeting. We have a quorum for today's meeting.

During today's meeting, the subcommittee will receive a presentation on technical topics regarding increased enrichment of conventional and accident tolerant fuel designs for light-water reactors rulemaking.

The NRC is proposed to amend its regulations related to the use of conventional and accident tolerant light-water reactor fuel design. The NRC goal is to establish effective and efficient licensing for the use of fuels enriched to greater than five weight percent uranium-235 while continuing to provide reasonable assurance of adequate protection to public health and safety.

The new requirements also would address fuel fragmentation, relocation, and dispersal in relation to the key accident tolerant fuel components of increased enrichments and burnup limits.

We had a subcommittee meeting in December 2024 on specific draft guide DG-1428, Plant-Specific Applicability of Transition Break Size. That one was not ready for discussion in December. In today's meeting we'll hear discussion on that one.

I might add that, if you look at the agenda, it's very full. And there are times allocated for various stakeholders' presentations. And I would ask that people do their best to stick to their schedule, because we also will have a meeting, basically a continuation, tomorrow. So any additional issues that may come up, I think we can deal with that tomorrow.

The ACRS was established by statute and is governed by the Federal Advisory Committee Act, or FACA. The NRC implements FACA in accordance with our regulations. Per these regulations and the committee bylaws, the ACRS speaks only through its published letter reports. All member comments should be regarded as only the individual opinion of that member, not the committee position.

All relevant information related to ACRS activities, such as letters, rules for meeting participation, and transcripts, are located on the NRC public website and can be easily found by typing about us ACRS in the search field on the NRC's home page.

The ACRS is consistent with the Agency's value of public transparency, and regulation in nuclear facilities provides opportunity for public input and comment during our proceedings. We have received written comments provided to the committee by two members of the public, Mr. Ralph O. Meyer, who was a former NRC employee some time ago, and Mr. Wolfgang

Wiesenack, in the form of a slide presentation. We have set aside time at the end of this meeting for any other public comments.

The ACRS will gather information, analyze relevant issues and facts, and formulate proposed conclusions and recommendations as appropriate for deliberation by the full committee. The transcript of the meeting is being kept and will be posted on our website.

When addressing the subcommittee, the participant should first identity themselves and speak with sufficient clarity and volume so that they may be readily heard. If you're not speaking, please mute your computer on Teams or by pressing star six on your phone.

Please do not use the Teams chat feature to conduct sidebar discussions related to the presentations, rather limit use of the meeting chat function to report IT problems.

For anyone in the room, please put all your electronic devices in silent mode and mute your laptop microphone and speakers. In addition, please keep sidebar discussion in the room to a minimum since the ceiling microphones are live, and they are very sensitive.

For presenters, your table microphones are unidirectional. That's an understatement. And you'll need to speak into the front of the microphone directly to be heard.

Finally, if you have any feedback for the ACRS about today's meeting, we encourage you to fill out the public meeting feedback form on the NRC's website.

And I'll proceed with the meeting. And I think Theresa Clark, Theresa, there you go, will have some opening remarks.

MS. CLARK: Thank you, sir.

Good morning, everyone. It's a pleasure to be here. I'm Theresa Clark, the Director of the Division of Safety Systems, and I'm one of the leads for the management review of this rule, which is really a momentous effort by the staff. And we appreciate all of the committees' engagement in thinking through the broad nature of the rule and how it can be implemented.

We think it's really helpful that there's going to be these additional comments from industry and the public, remarks that you mentioned. All of that is going to help us make an even better product.

We also particularly appreciate the

flexibility of the committee, for example, to provide this presentation today on the draft guide that wasn't ready in December. That allowed us to finish that up and to have a lengthy discussion today and tomorrow, which we think will be really useful.

And this is broad scope rule with a lot of envisioned benefits for both safety and operations, as well as cost optimization. And we really do see it as a way to advance the adoption of accident-tolerant fuel, increased enrichment fuel, and to be able to get to high burnup safely.

So it’s very important, but it’s also been a really ambitious effort by the staff on a tight schedule. One of the ways we were able to do that was by leveraging information to prior rule makings, from 2010 and 2017. That’s helpful for everyone, because there’s a lot of public record on the prior ACRS review of those that we could use to think through the process.

And, as you heard in December, and you’ll hear again from Joe today, there were a few things that felt right in 2010 or 2017 that just weren’t hitting right in 2024. So we’ve made some adjustments to deal with that.

Just a couple of other things I’d like to mention really quickly, we know that the guidance we’re putting down is one way of doing things. We’re totally open to workshopping other ways. And licensees may prefer alternatives on a case by case basis. But we are planning to have intensive engagement during the public comment period as is possible for every public meeting.

And at the same time, we recognize that there’s other options facilitated by (audio interference). The performance based requirements that appear at 50.46a would be able to be used by anyone, whether they’re adopting the transition break size risk-informed approach or not. And that could pave the way for some other options.

For example, the staff currently has under review EPRI's alternative licensing strategy, that's been one thing that could be facilitated by the rule language. And there’s other options that were talked about in the regulatory basis that could also be facilitated by that rule language. So we’re committed to continuing to think about how those could be adopted.

But it’s a rule that we’re proud of, and really proud of the staff, and I look forward to continuing to go back to those as we go forward.

Thank you.

CHAIR BALLINGER: That's it. Thank you. Who is going? Dave? Okay, the floor is yours.

MR. RUDLAND: Thank you. Good morning.

CHAIR BALLINGER: For better or for worse.

MR. RUDLAND: Yes, thanks. My name is Dave Rudland, and I am a senior technical advisor in the Division of New and Renewed Licenses, NRR. I'm joined by Rob Tregoning from of Office of Research and, online, Se-Kwon Jung from NRR, our Division of Engineering.

And the three of us will be presenting the basis for a draft Regulatory Guide DG-1428 which will, when published, will be Regulatory Guide 1.258, plant-specific applicability of the transition break size.

Next slide, please. I wanted to start this presentation by first getting a little bit of background on the basis for the transition break size. And then I'm going to go into a bit of history. Theresa alluded a little bit to some of the past work that was done, so I kind of wanted to lay the groundwork for what that was and how it fed into the development of this DG.

So, first of all the background for the transition break size, the basis, as we talked about in December, is on two published NUREG documents. Those NUREG documents were published in the early 2000s, NUREG-1829 and -1903.

1829 was a generic evaluation to provide best estimate LOCA frequencies. And that was done through the expert elicitation process that used both qualitative and quantitative processes to develop LOCA frequency estimates that were then combined to come up with the LOCA frequencies that are in 1829.

It used a ten to the minus five per year conservative LOCA frequency, and it was based on operating experience but also on a lot of engineering judgment and geometry. And it was chosen to try to promote regulatory stability in the definition of the LOCAs.

1903 came afterwards, and it was an analysis that looked into verifying the risks associated with seismic induced breaks that were greater than the transition break size and whether or not that was still a reasonable analysis given leak results.

1903 looked at two different things. It looked at direct piping failures and indirect piping failures. We'll talk a little bit more about that later on. And the NUREG concluded that both those indirect and direct failures had a mean failure probability on the order of ten to the minus six. So, it was well below the ten to the minus five criteria that was used for selecting the transition break size.

Okay, move to the next slide. So, the initial motivation for regulatory guidance back in the early 2000s was it was really noticed up front that all of the analyses conducted, both 1829 and 1903 were driven, could be driven by plant-specific attributes, and that those plant-specific attributes might influence LOCA frequencies that were calculated in those documents.

So, it was important to ensure that the TBS was applicable to each plant that may want to apply it. In fact, the Commission directed us, in SRM-SECY-07-0082, to develop regulatory guidance that would provide a method for establishing this justification.

And the staff interpreted that to be both for NUREG-1829 and 1903. So they developed DG-1216, which at the time was entitled plant-specific applicability of the transition break size specified in 10 CFR 50.46a.

Okay, next slide, please. So the scope at the time, the initial scope of DG-1216 applied to the primary loop piping and reactor coolant pressure boundary components whose failures would be greater than the proposed TBS.

It gave one acceptable method for demonstrating applicability to NUREG-1849 and 1903 for direct piping failures only. The effects of plant changes on both of those NUREGs was also present in the original draft guide.

The history of the guide itself, there were a lot of public interactions on that. We had initial public meetings, we had ACRS subcommittee meetings, we had main committee meetings, and we went through an extensive public comment period on the draft guide itself.

We had scheduled, actually, a Commission briefing on the DG itself, but as we talked about in December, the DG was withdrawn in 2016 after the staff and the Commission requested that the rule be abandoned.

Okay, next slide, please. So like I said, we got a lot of feedback, so I kind of want to go over some of that feedback. Our initial feedback from the ACRS is shown on this slide.

As it pertains to the rule itself, the ACRS concluded that the work that was in the DG-1216 provided an acceptable method and acceptance criteria for evaluating applicability to 1829. And it provided a good framework for analyses to demonstrate applicability to 1903 for direct piping failures.

But the ACRS indicated that we should expand 1903 to include applicability to indirect piping failures too, and how that may affect in the transition break size, as well as exploring methodologies or other efforts to reduce the effort that's required to demonstrate that applicability.

So the staff went forward and adopted those recommendations to add to the guidance for indirect piping failures, modified the FRN, and presented some initial ideas on how we may update the guidance to include indirect piping failures.

And that was presented in a public meeting in 2010. And how we plan to evaluate the acceptability could be done possibly as part of pilot study was recommended at that time.

Okay, let's go to the next slide. We received public comments also from both NEI and the PWR Owners Group. From NEI, they commented that the guidance was complex and proposed maybe a simple check list or something like that. They were concerned about this update to account for seismically induced indirect piping failures.

They requested that more reliance be placed on programs such as 50.59 and other existing programs to help reduce the plant change analyses. They suggested that we leverage the margins to provide competence that, sort of, it applies to all plants and that plant applicability maybe would not be required.

And they also suggested a pilot study prior to the final issuance of the draft guide to work out some of these issues.

The Owners Group had a lot of very similar comments. But in addition, they commented that they felt that the current inspections on these pipes provided adequate protection against large LOCA. They also recognized the complexity of the license renewal process but were concerned about plants that had not yet applied for license renewal. Because at that time, plants were just starting to do that.

And they suggested that plants that were in low seismic zones be exempt from demonstrating plant-specific applicability for 1903. They also had some questions about several of the requirements to acceptance criteria that were a part of the rule and some of the guidance.

Okay, next slide. So at the time, our next steps, at the time of the comments, the next step was to wait until the Commission voted on SECY-10-0161, which was the draft final rule before modifying the DG at all.

At the time, the plan was to not finalize the guidance until after the final rule was published and then to have these public interactions, and maybe a pilot study in place before finalizing the draft guide.

And some of the things that we planned to do as part of that was, again, add this method to address the indirect seismic analyses, conduct this pilot study that we talked about, address the comments, and modify the guidance. But as we pointed out in December, the Commission approved the staff's request to discontinue that rulemaking, and DG-1216 was withdrawn in 2016.

Okay, next slide. That's the history. So if we fast forward to a couple of years ago, the staff requested to pursue a rulemaking to develop a regulatory basis to amend the requirements to use light-water reactor fuel containing uranium enriched to greater than five weight percent.

And the Commission approved that in SRM-SECY-21-0109 but stated that FFRD, fuel fragmentation relocation disbursal, should be appropriately addressed.

Within the basis that was published, the staff included five options, which we talked about in December, and based on feedback, chose Alternative 2 which was basically the development to resurrect the work that was done in the early 2000 framework on the 50.46a rule that the draft guide that I just mentioned was meant to provide guidance for. And that was all, again, described in December.

And to support this rule, the staff decided to go ahead and revamp that DG and follow the Commission guidance to develop this type of guidance. And that's DG-1428 which is now titled Plant Specific Applicability of the Transition Break Size. And that's the main point of this discussion today.

Okay, next slide.

MEMBER MARTIN: I've been too quiet. You know, I can't stand --

(Simultaneous speaking.)

MEMBER MARTIN: -- you know, silent for too long.

So forgive me if this is kind of inane, but given the background, obviously pretty busy up until 2016. Since 2016, obviously, you highlight kind of the reboot of policy initiatives. Now prior to that, through today, have there been any really research initiatives or otherwise, you know, the high burnup uncertainties, and seismic impacts, that sort of thing, outside the policy space --

MR. RUDLAND: Sure.

MEMBER MARTIN: -- that the --

MR. RUDLAND: Yes, there's a --

(Simultaneous speaking.)

MR. RUDLAND: -- so in terms of LOCA frequencies and pipe failure, and all that, there has been an awful lot of work done in the 2000s, 2010s, and even into 2020s, looking at the failure, the probability of failure of these large pipes. Especially for the PWRs, we've had this issue, as you all know, on PWSCC for years and how that may impact the leak before break analyses that were done.

Both the industry and the NRC developed extensive analyses to look at the LOCA frequencies and the failure frequencies of these pipes as they may be impacted by PWSCC. A lot of the work that Theresa mentioned that the EPRIs suggested for ALS leveraged that work. So, a lot of that's been done. So, we understand more about LOCA frequencies and pipe failures than we did back in 2010 time frame.

MEMBER MARTIN: So while policy kind of stopped --

MR. RUDLAND: Yes, policy kind of stopped.

MEMBER MARTIN: -- knowledge development --

MR. RUDLAND: That’s right, technical work --

MEMBER MARTIN: -- continued.

MR. RUDLAND: -- continued. That’s right. Not so much for the BWRs but mainly for the PWR pipes, yes.

Okay, let’s move to the next slide. So, I wanted to kind of talk a little bit about where in the proposed rule that we presented in December are the areas that are supported by this particular DG.

So if you look through the rule in the application section in 50.46a©, there is a requirement that for the existing plants they must demonstrate the applicability of the transition break size.

For new plants, they have to demonstrate similarity in plant design and recommend and justify plant-specific TBSs. For both new and existing plants, if changes are made, there is a requirement that they must demonstrate that the TBS remains applicable. And there is a requirement that they demonstrate applicable leak detection programs.

There’s also an optional process that they can go through, a self-approval process, where they can make changes without NRC approval. But they still need to describe the process for how they're going to demonstrate TBS applicability.

Under the 50.46a(d), there's a requirement to, again, to identify, monitor and quantify leakage, and to perform evaluations to demonstrate the TBS remains applicable through any plant changes that may occur.

50.46a(h) proposed changes enacted with or without the approval must demonstrate continued applicability of the TBS. And in the reporting section in 50.46a(j) it must document the basis for determining that changes enacted without prior approval don't invalidate the TBS. So, all of those different rules in there are supported by this work in the draft guide.

CHAIR BALLINGER: This is Ron Ballinger. I didn't know when to ask this question or comment this way, but all of the work that's been done during that interval period, one of which is the mitigation of all these welds, in some way, and combined with the leak rate requirement, what do you think the probability is of LOCA now?

MR. RUDLAND: So, I'll make -

CHAIR BALLINGER: Want to think in real

world.

MR. RUDLAND: So, I'll make the first comment, that not all the welds are mitigated. The Inconel welds, some of the Inconel welds are mitigated, but others are being periodically inspected to make sure that they --

CHAIR BALLINGER: That's what I meant by mitigated in some way, N-770, or something like that --

(Simultaneous speaking.)

CHAIR BALLINGER: -- and I'm talking about dissimilar metal welds.

MR. RUDLAND: It's just the dissimilar metal welds.

CHAIR BALLINGER: Yeah.

MR. RUDLAND: So what do I think the LOCA frequencies are? It's a little bit of a loaded question. I mean --

CHAIR BALLINGER: It was supposed to be.

(Laughter.)

MR. RUDLAND: I think for the PWRs that have been shown to have PWSCC, I think both the industry analyses and the NRC analyses have demonstrated that they are extremely -- they're the order of ten to the minus six types of annual frequency of rupture.

That's what most of the analyses have shown. Does that answer your question?

CHAIR BALLINGER: Sort of.

MR. RUDLAND: Well, ask it one more time, I'll see if I can answer it next.

CHAIR BALLINGER: You used the word zero in one of the previous meetings, so I'm just curious as to how far below ten to the minus six.

MR. RUDLAND: I will never say zero when talking probabilities.

CHAIR BALLINGER: Okay.

MR. TREGONING: And just recognize that the similar metal welds are a very small percentage of the type of welds that are in these systems. Most of the welds are similar metal welds that are not mitigated in any way other than they're part of their --

MR. RUDLAND: And significantly --

(Simultaneous speaking.)

MR. TREGONING: -- typically a risk-informed inspection program, okay? A risk-informed ISI program. They're not in 770 welds. That's only a very small percentage in welds. That's only the dissimilar metal welds.

CHAIR BALLINGER: But how many of those are the TBS, beyond TBS welds?

MR. TREGONING: All of the similar metal stainless steel welds that run in the hot leg, cold leg, cross upper leg, and the recirc stuff --

MR. RUDLAND: That's the propensity of the welds.

CHAIR BALLINGER: In BW?

MR. RUDLAND: BW.

CHAIR BALLINGER: Those are the similar metal welds you’re talking about.

MR. RUDLAND: That I will talk about here in a few minutes.

CHAIR BALLINGER: Those are the -- somebody, is there a hand up?

VICE CHAIR HALNON: No, I was going to remind Robert to state your name.

MR. TREGONING: Sorry, Rob Tregoning, NRC.

VICE CHAIR HALNON: The court reporter doesn’t know --

MR. TREGONING: Understand, thank you.

MR. RUDLAND: Okay, let’s move to the next slide. So, the purpose of this particular draft guide, again, lies in the fact that the proposed rule requires an evaluation to demonstrate plant-specific applicability to TBS. And this draft guide provides one acceptable way.

And as Theresa pointed out earlier, there are other methods through the rule where other things can't be used to do this demonstration. But if it can't be demonstrated through whatever means, they can develop, a plant-specific entity can develop a plant-specific transition break size. And this guide may also help them in doing that.

MEMBER MARTIN: Bob Martin, just a clarification, so the 1216 ended 2016. And here we are with 1428. You, of course, mentioned that you had, you know, re-booted some stakeholder engagement after 2021. Those comments that came in at the end of 1216, now they informed what we have here today so --

MR. RUDLAND: Yes.

MEMBER MARTIN: -- you know, the concerns about complexity and seismic failure, that's been responded to and --

(Simultaneous speaking.)

MR. RUDLAND: We tried the best we could to reduce the amount of burden that they suggested in their comments.

(Simultaneous speaking.)

MR. RUDLAND: Yeah, and tried to simplify the process, especially for those approved programs that they have at the plants, now, that maybe they didn't have back at the time.

MEMBER MARTIN: And we might hear more about that?

(Simultaneous speaking.)

MR. TREGONING: Even though we did consider those comments and we tried to address this, it doesn't mean that we might not get some of those same comments associated with this draft copy.

MEMBER MARTIN: I know who my audience is right now, so I'm taking advantage of it.

MR. TREGONING: So, believe me, we're not naive enough to expect that this is a perfect reg guide that all the stakeholders are going to readily embrace. There'll be some things that we'll need to work through.

MEMBER MARTIN: I do have --

MR. TREGONING: Oh, yes.

MEMBER MARTIN: -- you did ignore it.

(Simultaneous speaking.)

MEMBER MARTIN: It's gotten in here.

MR. RUDLAND: And I'll try to point those out as we --

MR. TREGONING: We'll point it out. But again, we -- the point that Dave's trying to make, we did a lot of work to get out 1216, and jumped through a lot of hoops including going through a public comment. So we wanted to leverage that work as much as we could. Because we weren’t starting from a blank slate here. You’ll see the 1428, you know, owes its existence to 1216.

MEMBER MARTIN: And that's why I think it was important to get it on record here. There’s a continuity, and it might have been a few years of policy lapse, but there is some continuity from all that work to what you have today.

MR. RUDLAND: Okay, next slide. So, I wanted to give a quick overview before we go into the details of 1428. As we just talked about, 1216 was used as a starting point. And then you -- thank you for being my straight man there and setting me up for this slide.

We tried to leverage a lot of the programs that they have in place, like license renewal, leak before break, those kinds of things, as well as required inspections to really streamline and simplify the guidance from 1216.

We considered the 1216 comments in doing that. We provided guidance to address indirect seismic failures, tried to address the recommendation of the ACRS from 2010, and tried to keep the guidance consistent with the rulemaking requirements and leverage the DG-1426 guidance as much as we can.

And just a reminder, the 1426 guidance is the -- we had a brief on that in December also, and it was the risk-informed evaluation process supporting this acceptance criteria for the ECC systems and LWRs.

And the other thing we wanted to do with this guidance is provide a multitude of options so that we weren't just giving one particular recommendation for guidance, but we're giving licensees options on how they can meet these different criteria.

And we do propose again to try to use a pilot study, or workshops, or something like that in between the draft and final to work out the details on this type of guidance.

Next slide, please. So, this is just a graphical overview of what we're going to be talking about for the remainder of the morning. I'll start talking about the NUREG-1829 applicability and its attributes. Se-Kwon, who is on virtual, will be talking about the 1903 applicability, and then Rob will be talking about map changes and LOCA frequencies toward the end of this presentation.

VICE CHAIR HALNON: Dave, this is Greg

Halnon. I'm just going to get this one question off my chest again. I think it's been answered, and I don't know if it's been answered to where I don't have the question again.

Back in the last meeting, we talked about the initiating event frequency being very low for LOCAs above the transition break size. And then also that the risk increases for plant changes is very minor. But then the third bullet was what is going to maintain regulatory control of these LOCAs.

MR. RUDLAND: Consistency, I think is what --

VICE CHAIR HALNON: I still don't understand, in a risk-informed thought process, why LOCAs greater than a transition break size specific to the plant, why we have to maintain regulatory control over this?

MR. RUDLAND: Well, I think the point was regulatory consistency. So, we wanted to publish the transition break size so that we would have the same rules for every plant, right. If we allowed -- which is a process we could do, we could allow the calculation of their own transition break size, but that provides, across the industry, different things from different plants --

VICE CHAIR HALNON: This is not --

(Simultaneous speaking.)

MR. RUDLAND: -- consistency from a regulatory framework. It's not --

VICE CHAIR HALNON: -- on a current licensing basis specific to the plant does flow for –

(Simultaneous speaking.)

MR. RUDLAND: And they have the opportunity to do that.

VICE CHAIR HALNON: They have the opportunity to say I'm above this transition, or these plants are above the transition break line, therefore I don't have to worry about them anymore. We're not giving them that option at his point.

MR. RUDLAND: No, again, I think, you know, the selection of the transition break size was done through a variety of analyses, right. And so, even if the probability of something is low, we need to continue to monitor to make sure that the analyses that we did was still representative in the future.

VICE CHAIR HALNON: See, that seems contrary to the risk-informed –

MR. RUDLAND: No, that's actually part of the risk-informed decision making process, is that performance monitoring needs to be done --

VICE CHAIR HALNON: Performance monitoring is one thing, but maintaining regulatory control over it -

MR. RUDLAND: By regulatory control you're talking about the LOCA analyses?

VICE CHAIR HALNON: Yes. Well, we're going to get into this in the diagrams coming up.

MR. RUDLAND: And we talked a lot about that in December, right, the notion that we're creating --

(Simultaneous speaking.)

VICE CHAIR HALNON: Right. I still don't understand why we're even here if the plant can justify TBS and it's --

VICE CHAIR HALNON: I'm going to phone a friend about that.

MR. MESSINA: Yeah, this is Joseph Messina from the staff. And we did that to maintain consistency with other beyond design basis actions such as ATLAS and station blackout which we still do the analysis for.

VICE CHAIR HALNON: Okay. I'm not convinced yet, but we'll go through it and maybe I'll stay a skeptic, I don't know.

MR. RUDLAND: I just want to make sure that we're clear. In this particular guidance, we're not talking about the LOCA analyses at all, right? We're talking mainly about the calculation of the transition break size --

VICE CHAIR HALNON: Right.

MR. RUDLAND: -- just to be clear.

VICE CHAIR HALNON: I get that. We're talking about all the other industry and stuff going on, like ALS and stuff that will eliminate these large break LOCAs. I'm not sure why we just don't eliminate the large break LOCA and say we're done. Same thing with what Ron was saying, relative to the mitigated, in some way.

So, it seems like all the cards are stacking up to where we're saying we don't need to be concerned about breaks involved with TBS, and even if you put some margin on it.

Go ahead, I got it off my chest and I'm good, we're good to go.

MR. BLEY: This is Dennis Bley. More than getting it off your chest, the argument, if we believe the results of these analyses, it used to be spelled out. I forget where it's spelled out. But design basis accidents are things that have frequencies of occurrence bigger than about, in the range of ten to the minus three to ten to the minus four per year.

And if we're saying these are much lower than that, we don't need to be consistent with other design basis accidents. This shouldn't be a design basis accident anymore.

VICE CHAIR HALNON: I don't think there's an answer to that --

(Simultaneous speaking.)

VICE CHAIR HALNON: I think we're in agreement. I appreciate that.

CHAIR BALLINGER: We never promised you a rose garden.

MR. BLEY: Well, I think --

(Simultaneous speaking.)

VICE CHAIR HALNON: The question to ask when EPRI presents on ALS this afternoon, I think they made the point at a meeting we had several months ago that the real problem is how much the LOCA is buried in regulation, how much effort it would be to get it out of regulation.

And so they chose an alternative that still keeps it a regulation but still has a solution to the civic FFRD problem for break line, transition breaks. I think we have to revisit this question when they're up.

Okay, thanks, Tom. It's a burning question in my mind that I wanted to reconcile. So go ahead.

MR. TREGONING: And I think it's a good question, right. And it's a good discussion point. The one thing I will say is one of the reasons that the risk associated with large break LOCAs is low is the fact that the plant's designed specifically to combat that.

And potentially, under this rule, they'll be allowed to make changes that might peel back some of the things that they did to mitigate the large break LOCA. So by definition, then, the risk will increase by some degree.

And I think what we're trying to do is make sure, as part of this rule, that those increases in risk due to the large break LOCA remain acceptable. So that's the balance that I think we're trying to strike here.

But your point, it's almost as philosophical in a policy discussion as much as anything, you know, how much relaxation is appropriate. Should there be a regulatory book at all? Those are all, I think, part of this debate.

And as this rule continues to wind its way through, hopefully to the Commission and out to the public, I'm sure that particular point will be discussed quite vigorously.

VICE CHAIR HALNON: That's not why we're here.

MR. RUDLAND: No. And again, whether or not there's regulatory components that will allow large break LOCAs, it doesn't, again, it doesn't change how this break between a smaller break and a large break occurs. And that's kind of what we're here to talk about today.

So, let's go to the next slide. For each of these topics that I talked about there's going to be this flow chart. This flow chart is in the draft guide. And it's basically just to kind of give a visual flow for how the approach works. And there's a couple of things I want to point out about this before I get into the nitty gritty details.

It's trying -- the approach is trying to leverage, the best that it can, the processes that have been used and approved in the past with the Agency for the different topics.

So the two main topics, aging management and analyzing plant-specific attributes, are the two main topics in describing 1829 applicability. However, if a plant has an approved license renewal, an approved license renewal submittal, and they have an adequate leak -- which most plants do, when they have an adequate leak detection system, which most plants do, and have an approved LBB analysis, which most PWR plants do, the flow through this goes right to accepting the NUREG-1829 applicability.

To follow the flow through all of that, they note there's no additional analyses that are needed. So, we try to leverage those programs, the license renewal program, the leak before break programs, the leak detection systems, to get through this without any additional analysis.

If there isn't those things in place, then the DG describes the analyses required to match the same requirements that were in those that were accepted. So for instance, in Option 3 under aging management, perform alternate evaluations, is basically doing the same kind of thing, in developing the goal and developing these management programs, that was done as part of the license renewal or subsequent license renewal process.

On the other side, if a plant doesn't have leak before break analysis, they have the option to do a probabilistic fracture mechanics analysis or a deterministic style LBB type of analysis which has all of the rules in the DG that they need to follow. So the process was set up to be able to do that to allow them to leverage those programs without doing any additional analysis.

As you'll notice at the very bottom is developing an inspection sample. I'll go into that in a little bit more detail, and the goal of that and the gains that are brought forward because of that requirement. So in the next few slides, I'll go through some of these details.

So next slide, please. So again, before NUREG-1829, aging management, leak detection, and plant-specific attributes are the main things that need to be examined and strengthened.

For aging management, again, there's three options. In the draft guide, to be able to read that, first one is you can take credit for a license renewal or subsequent license renewal approval if your plant has that.

If you've submitted license renewal but have not been approved, you adopt the relevant aging management programs that are in your submittal that would meet that -- that would show applicability.

And if you don't have either of those, then you have to demonstrate that the Part 54 requirements are met for the applicable primary loop piping or reactor coolant pressure valve components.

For leak detection, again, there's a couple of options. The first is to demonstrate adherence to REG Guide 145 which most plants have done. Or if they haven't done that, then they can demonstrate compliance with JAC 30 and 50.46a(d)(ii) criteria.

The plant-specific attributes, which I'll talk about in more detail in the next slide, ensure that the piping attributes are acceptable. And if you are a new plant, which is one that's licensed after December of 2015, you've got to conduct these component evaluations to demonstrate that things are similar. And then you have to develop this acceptable risk-informed primary loop piping inspection sample.

Okay, let's go to the next slide. All right, so for the plant-specific attributes, again, before I get started on this I've got to make the comment that this slide was modified just recently, I believe, just a day or two ago. And so, the version that you may have had did not have -- might not have this. But it's been updated in public ADAMS and such like that. So I just wanted to make that clear.

For the PLP attribute evaluation there are three options in the draft guide. The first is to credit existing LBB programs or conduct a new LBB evaluation. If the plant decides not to do that, then they conduct a PFM evaluation. And the details of how to do that in the acceptance criteria are in the DG.

Or they can do those identifying attributes and conduct a more deterministic analysis which, again, the details and the acceptance criteria are in the DG.

If they're a new plant, they have to identify the unique plant-specific attributes and assess whether those impacts to those differences occur at all on the TBS applicability.

And finally, this risk informed inspection sample, the rule calls for ten percent of similar metal piping welds in PWRs or IGSCC Category 4 welds, that PWRs with diameters greater than the TBS be inspected periodically.

We also allow in the rule the option to leverage ongoing inspection programs so that if a plant is able, they can move their inspections around and not require any new inspections to meet this particular rule.

And again, the highest failure potential welds need to be chosen. The advantage of these welds are twofold -- the advantage of these inspections are twofold.

First of all, for the analyses conducted in 1829, which are typically fracture mechanics type-based analyses that use assumed criteria, assumed craft mechanisms, and such, it allows us be able to continually monitor those particular welds that were used in the basis for 1829.

Like I mentioned earlier, it becomes kind of our performance monitoring to be able to make sure that the analyses conducted don't change and that there's nothing impacting those particular pipes that may not be part of -- may not have had inspections in the past.

It also allows us to leverage greatly in the 1903 analysis, which Se-Kwon will talk about later, that allows us to leverage those inspections to remove any additional analyses for the seismic analyses also. And Se-Kwon will talk about that in a bit.

So the advantage is twofold. And the hope for these analyses is that no really additional inspections will have to be performed, that the industry will be able to revamp the risk-informed programs to include these particular welds in their program.

I should point out that these particular welds are in a risk informed category right now. And there are ongoing efforts and code to change the inspection requirements of that particular category.

And we want to ensure that those particular high failure potential welds remain inspected through the course of the plant life that are using this particular --

CHAIR BALLINGER: This is Ron Ballinger again. You may not know the answer. I'll maybe ask the same question this afternoon. But how many of the plants -- where would the plants that currently exist, is there a map that puts them somewhere in those block diagrams?

MR. RUDLAND: Yes. They have. I'm sure they have.

CHAIR BALLINGER: The inspections you're talking about?

MR. RUDLAND: Overall 1829 -- Yeah, yeah, yeah, yeah.

CHAIR BALLINGER: Or you know which plants where they sit?

MR. RUDLAND: For the most part. I know that all of the, all of the PWRs have approved LBB programs, for instance. None of the BWRs, and we know that. Every plant except for one have a license renewal and, yeah, that one is coming in. So, I know where all the plants are.

I know that all the plants have taken the leak rate detection reg guide and incorporated that in their plants. So, I know that most of the plants will be able to easily sift through these flowcharts without doing additional analysis.

CHAIR BALLINGER: Okay. So that where is the hard point?

MR. RUDLAND: The hard point is that I don't know for sure. I don't know exactly.

CHAIR BALLINGER: Before, the inspection sample was the hard point.

MR. RUDLAND: Well, the hard point is also that I don't know exactly where these welds fall in their risk-informed inspection programs. So, the category that I talked about consists of all of the stainless steel welds in the reactor coolant, not just the ones rated in the TBS.

I don't know if plants are inspecting these welds as part of their programs, for instance. Some may, some may not. Some plants may be doing these inspections and so there's no additional burden whatsoever. Some plants might be doing zero of these sets.

CHAIR BALLINGER: That's what I'm trying to get at.

MR. RUDLAND: I don't know.

MR. TREGONING: We don't know, we don't know that. That's not something we know.

MR. RUDLAND: That's why we want to make sure that we gave them the opportunity to leverage their programs and modify their programs to include these welds, if possible.

CHAIR BALLINGER: Thank you.

MR. RUDLAND: The goal, again, is not to impose new inspections on the issue. That's not, that's not the goal. The goal, again, is to let them leverage their programs, but we still want to be able to performance monitor those welds we think are most important for defining what this TBS is.

Okay. If there's nothing else, I think that's about all I'm going to say about 1829.

I'm going to turn the floor over to Se-Kwon who is going to talk about 1903.

MR. JUNG: Thank you.

(Audio malfunction.)

MR. JUNG: -- progress covering the plant-specific applicability of the NUREG-1903 analysis results.

The outline of the presentations is as

follows:

First, I will talk about acceptable methods for conducting analysis of direct flawed piping failure. This includes discussion of general approach, limiting locations selection, applicability demonstration through inservice inspection program, component stress determination, material properties selection, and surface flaw analysis.

Then I will discuss acceptable methods for the analysis of seismic risk associated with indirect seismic failures.

Next slide, please.

The flowchart on this slide is showing the general approach taken for direct flawed piping analysis.

As shown in that first top box on the left slide of the slide, the approach starts with establishing the analysis scope by identifying what piping systems, what locations have an inner diameter that is greater than transition break size.

This is followed by determining limiting locations within in-scope primary piping for the remaining steps of the analysis.

For each of the new locations there are two possible actions. There are pathways available to demonstrate the applicability of the NUREG-1903 analysis results.

Someone is talking. Can you press them on mute, please.

CHAIR BALLINGER: We're getting some feedback somewhere.

MR. JUNG: Yeah.

Thank you. Appreciate that.

So, again, for each of the limiting locations there are two possible options or pathways available to demonstrate the applicability of the NUREG-1903 analysis results. It depends on whether the selected limiting locations are part of the existing inservice inspection program or not.

If the limiting location is part of the existing inservice inspection program, the approach is greatly simplified.

As shown on the leftside branch of the slide, the only remaining step is to check whether the limiting location meets the requirements of the ASME Section XI IWB-3500 or 3600.

If these requirements are met, then NUREG-1903 results are directly applicable to the limiting location of interest, and no new analyses are required. This will significantly reduce the amount of time and efforts for the entity, for applicant to demonstrate the applicability of the NUREG-1903 analysis results.

We anticipate that many entities or licensees will take advantage of this option by passing through that analysis.

However, if the IWB-3500 or 3600 parameters are not met, or the limiting location is not part of the existing inservice inspection program, more detailed analyses are required, as shown on the rightside branch of this slide.

This includes determination of component stresses, material properties, and conducting either a deterministic analysis or best estimate probabilistic pressure mechanics analysis, as shown on this chart.

In subsequent slides I'm going to discuss each of these areas discussed in more detail.

Next slide, please.

Limiting locations selections. As mentioned in the previous slide, for all piping system locations having an inner diameter greater than the transition break size we should find all limiting locations that are represented by combinations of high component stress and low material fracture toughness. We also account for aging effects over the licensing period.

Susceptibility to service-induced cracking is another consideration.

Multiple limiting locations may need to be delineated if the limiting location is not obvious.

The key requirement in the selection of limiting location is the entity or licensee should strive to include all limiting locations in the inservice inspection program.

Next slide, please.

Operators looked at the demonstration through inservice inspection program. As mentioned earlier, for those limiting locations that are part of the existing inservice inspection program the plant-specific acceptability of the NUREG-1903 results can be demonstrated through the successful application of the program.

In other words, no other variation of analysis is required if there are no new or preexisting indications larger than the ASME Section XI IWB-3500 acceptance criteria.

Next slide, please.

However, if significant limitations exceeding the IWB-3500 acceptance criteria exists, additional analyses are required to demonstrate their acceptability by performing an analytical evaluation of flaws for IWB-3600.

Obviously, if the limiting locations are not part of the existing inservice inspection program, then analyses must be used to demonstrate the applicability of NUREG-1903.

Next slide, please.

Component stress determination:

For limiting locations not part of the existing inservice inspection program, the next test is to determine component stresses used in the subsequent steps of the analysis. There are three possible options:

Option 1 is to use the NUREG-1903 results. This option is available for entities whose plans were analyzed in NUREG-1903 considering the following three conditions are met.

The first condition is that the critical piping locations reported in the plant's leak-before-break submittal are applicable, after accounting for cracking susceptibility and as related to toughness degradation at these locations.

The normal operating and the safe shutdown earthquake stresses in the leak-before-break analysis are either accurate or conservative at these limiting locations.

And the third condition is the site-specific hazard curve. And we know from hazard spectrum contained in the current specific sizing hazard and report are either conservative or represented by the applicable sizing hazard curve within the NUREG-1903.

If these are conditions are satisfied, the entity or licensee can use the plant-specific total stresses developed in the NUREG-1903 analysis through the remainder of this analysis.

Option 2 is to use the NUREG-1903 scale factor method. This option uses the scale factor method described in the NUREG-1903 to determine the total component stresses at each limiting location.

The entity should first develop seismic hazard information, as mentioned earlier, by determining site-specific seismic hazard curve. And we know from hazard spectrum using the current seismic hazard screening report information tied out to 10 to minus 6 probability resiliency.

Next, at each limiting location the entity should determine the axially oriented, normal operating and safe-shutdown earthquake stresses for service level A and D respectively.

Finally, the entity should extrapolate the

SSE or safe-shutdown earthquake stresses to seismic stresses representative of the 10 to minus 6 probability of exceedancy.

Option 3 is the most accurate option as it requires direct seismic response analysis. But, at the same time, the most complicated and time consuming approach.

For this analysis the entity should first determine the axially-oriented owner operating stresses at the limiting locations.

Then the entity should determine seismically-induced component stresses by completing following tests:

First, develop an updated representative site-specific hazard curve and ground motion hazard spectrum for the 10 to minus 6 probability of exceedancy based on the latest seismic hazard information.

Then model the site-specific foundation properties corresponding to 10 to minus 6 seismic hazard curve.

And then construct a reactor building dynamic model, including all major structures and also anti-blast systems.

And then perform a soil structure

interaction analysis for the given site on seismic motion using applicable soil, rock and structure models.

And, finally, also we need to address modeling and input uncertainties and the effects on the primary piping stress at the limiting locations.

Next slide, please.

For determination of material properties, one acceptable approach is to use the properties associated with either the conservative base and well materials, or stainless steel submerged aqueal materials used in NUREG-1903 by demonstrating that these properties are conservative or representative of actual plant-specific properties at the limiting locations.

Alternatively, the entity or licensee can develop representative or conservative plant-specific material properties based on ASME code, generic, or measured properties.

The acceptability of the NUREG-1903 properties or the appropriateness of the developed properties can be demonstrated by accomplishing the following three steps:

First, account for any age-related degradation of strengths, toughness, and, if applicable, crack growth rate properties;

Second, considering effects on these material properties caused by the elevated loading rates associated with a seismic event, and;

Third, assess the effects of uncertainty and variability on the material properties.

Next slide, please.

Once component strengths of the material properties are determined, there are three options for surface flaw analysis.

The first two options are deterministic, and the third option is probabilistic.

Option 1 or the first deterministic analysis option is bounding analysis.

This option directly utilizes NUREG-1903 results if the material properties used in NUREG-1903 appropriately represent plant-specific material properties.

And the axially oriented combined normal stresses plus 1 to the minus 6 stress.

Proper consideration of seismic stress factor and elastic stress factor, if the stress is less than 35 ksi.

Option 2 is the second deterministic option. It's perform plant-specific deterministic analysis, if the full stress is greater than 35 ksi or if plant-specific material properties are not appropriately bounding or representative of the NUREG-1903 material properties.

This analysis utilizes plant-specific material properties and stresses with appropriate consideration of plasticity correction factor to account for plasticity within components on the seismic loading.

A critical flaw depth is calculated using the corrected limit load analysis or a Z-factor approach or elastic plastic mechanics using a long surface flaw lengths of 80 percent of the component circumference, which is quite conservative.

If the critical flaw depth exceeds 25 percent of the wall thickness at each limiting location, then NUREG-1903 results are directly applicable to the plant.

Next slide, please.

The third and most sophisticated option is to perform a plant-specific probabilistic fraction mechanics analysis.

As shown on this left side of the slide, this probabilistic analysis should be consistent with Reg Guide 1.245. This is concerned with preparing probabilistic fraction mechanics summaries.

And the acceptable probabilistic fraction mechanics analysis should include the following six considerations:

First, the analysis for the limiting locations should be determined following that of the deterministic analysis as described previously;

Second, an applied stress distribution should be developed for each limiting location. One of the three options described previously to develop component stresses for the deterministic analysis can be used to pick out the mean value of this distribution;

Third, the analysis should use property distributions for key analytical parameters such as material strengths, crack growth rate associated with the applicable degradation mechanisms, and fracture toughness;

Fourth, the analysis should assume an initial flaw distribution based on either known flaw distribution or distribution corresponding to the flaw detectability size from the non-destructive determination method;

Fifth, the analysis should select an appropriate failure criterion, such as defective criterion or failure criteria such as failure assessment diagram or inherent instability;

The sixth consideration is the analysis should apply applicable leak detection limits with a known uncertainty.

Taking all these six considerations together, the analysis should be run up to 80 years. And this guidance recommends that the resulting mean failure probability of the piping system contained in the limiting locations should be less than 1 minus six. This is to ensure that it does not inadvertently contribute to the overall total LOCA risk.

In addition, as shown on the right-side of this slide, this guidance recommends performing a series of sensitivity analysis studies for key analytical parameters such as seismic stress and flaw lengths distributions, as well as other key parameters that may significantly affect the analysis results in accordance with Reg Guide 1.245.

In addition, recommendations of limiting the resulting probability of failure increased no more than two orders of magnitude.

Next slide, please.

Seismically induced risk of indirect component failures.

The original NUREG-1903 study results, as well as the recent evaluation study results have shown that the seismic risk associated with primary low piping failure is dominated by indirect component failures leading to piping failure.

Acceptable methods for this mode of piping failure should consider most up-to-date plant-specific seismic hazard information;

Plant-specific component and support fragilities;

And the effects of age-related degradation on these fragilities.

This analysis can be performed in a graded manner:

First, the most sophisticated approach is to develop the first seismic PRA that complies with Reg Guide 1.200.

Typically, the assessment of the seismic risk associated with the indirect piping failure leading to LOCA scenarios should be part of this analysis.

Additional guidance and acceptable guidelines performing risk-informed evaluation of the indirect piping failures are described at DG-1426.

Last, the request compared to seismic PRA are more efficient and simplified acceptable approaches available such as seismic margin assessment to perform the same analysis, if that analysis is appropriately justified.

This concludes my portion of the presentation. And then I'll turn it over to Robert.

CHAIR BALLINGER: This is Ron Ballinger again.

My memory is a little bit fuzzy, but recently the plants were asked to reevaluate the seismic risk based on the new GMRS some time -- I forget how many years. That being the case, would that evaluation satisfy 1903?

I don't know. I'm just saying some analysis had to be done as a result of that new ground motion response spectrum.

MR. JUNG: Yes. As part of this reg guide development we evaluated the effects of updating seismic measures on the results of NUREG-1903. And I presented the results in the last month's presentation.

Basically, overall the seismic risk associated with the indirect piping failure were all generally less than 1 to minus 5. That was the high level conclusion.

MR. TREGONING: So, that would be part. That would be part of what would be required in the analysis. So, they would leverage -- Rob Tregoning again from the staff. Sorry.

So, yes, that would be part of the analysis.

I want to, I want to sort of harken back to one of Bob's earlier points when he asked, you know, how much work have you done in this area since, you know, the early two thousand naughts?

And as Dave articulated, we, we've done a lot of work that's given us more insights in terms of what we studied, in terms of LOCA frequencies in 1829, and applicability with respect to TBS.

But these analyses of direct piping failures due to rare seismic events, that's not something we've done any additional work on since NUREG-1903 was out.

And NUREG-19 -- and seismic evaluations, NUREG-1829 can be a generic evaluation for developing LOCA frequencies makes sense. Can't say anything generic about seismicity and seismic sensitivity. It's a very -- it's entirely plant specific.

So, when we developed 1903 we used the best available plant-specific information that we had to date, 26 PWRs. But that used seismic hazard curves from, I think '97, which at the time was the most recent, but even when we did 1903, plants, we knew plants were in the midst of re-doing their seismic hazard curves.

And then we used the best available material information that we had and some loading information we had from LBB submittals. But even those were dated. A lot of those LBB submittals were from, you know, the Nineties.

So, you know, there was a recognition at the time that -- you know, and this is my opinion -- you know, that we think this is an area that if there was some more technical work done using up-to-date plant-specific information, that would really go a long way in addressing this applicability.

And to get to Ron's point of, well, how many plants fall into different bins, you know, we set the DG-1428 for demonstrating 1903 applicability. It's a graded approach; right?

If you pick the simplest option, you just have to demonstrate that the analysis that was already done for your plant for 1903 remains bounding. Right?

You have to say, oh, the stresses that they used in 1903 were higher than my stresses with my revised seismic hazard curves. And the material properties that they used either bound or represent my material properties, so I'm good.

So, that's one step.

But then, you know, if you can't, if you can't do that, then there's another step which is to use the scale factor method. So, you actually go through the 1903 analysis but use all your plant-specific inputs for doing that analysis. And then that's another way to demonstrate applicability.

And then the third way is, well, if I don't want to do either one of those, I've got to do a complete plant model and develop my stresses from the ground up. And that's, that's onerous, but that's an option.

And then the fourth option is this probabilistic fracture mechanics analysis. Because 1903 only looked at -- it's only a deterministic analysis.

So, there's a recognition that while we were able to simply DG-1428, even quite significantly to deal with the NUREG-1829 applicability question, we weren't able to do as much simplification to deal with the NUREG-1903 applicability question just because looking at piping, looking at degraded piping fragilities under rare seismic events is just not a topic that we really looked at more extensively since we did it in the mid-2000s.

So, that's, that's some --

MR. RUDLAND: I can also add which is why we -- why they put the option is that they can include those limiting welds in their ISI program, then they don't have to do any of this.

MR. TREGONING: Right. So, you can inspect your way out.

MR. JUNG: Yeah. And that's why the analysis studies done originally in NUREG-1903 were kind of representative. And the results show that indirect seismic failure was one zero of 10 to minus 6.

However, due to the seismic hazard updates since then, we recognize that the risk would be hard to compare. And we performed, actually, representative, you know, analysis considering the seismic hazard and the results have shown that overall most of the plants in the United States, in the central part of the United States, their indirect piping failures would be less than the transition break size. That was the conclusion.

But that analysis used actually represents -- representative component seismic fragilities. So, that needs to be confirmed by some sort of considerations.

MEMBER MARTIN: And I'm going -- this is Bob Martin -- I'm going to show my ignorance, I'm not a seismic person per se -- but what I understand with 1903 that's kind of different from the past, it's all, it's past referring to existing inservice inspections which I focus more on stress versus cracking, you know, like, like topics. Should we bring in more of the seismic failure analysis and at the same time we're saying it's risk informed and we'll be looking at events, loads that go down to 10 to the minus 6.

It's really kind of back to, to Greg's question, why don't we, you know, under risk informed you might say 10 to the minus 4 events, which of course mean it's under TBS type events. It almost seems deterministic, except where we stick a number 10 to the minus 6, one in a million.

It seems like it's a misnomer almost to say 10 to the minus 6 other than the fact that, you know, we can put a number on it and we're not going to look at, you know, 10 to the minus 8. I'm not sure what's different than a deterministic approach. You just kind of slap a --

MR. TREGONING: Oh, right. We're not subtracting; right. If you use the 10 to the minus 6 seismic hazard --

MEMBER MARTIN: Really for everything --

MR. TREGONING: Yes.

MEMBER MARTIN: But what do you do, there's no relaxation, no graded approach.

Now, this is the kind of things. I've been looking. You know, we've all been asked to bring in more risk informed insights into this sort of stuff. And here we go, I think we're almost adding a little bit more than what we've always been doing.

And, you know, I'm not someone to make -- I mean, I guess I am on this committee making a recommendation -- but I'm not the lead person on this, you know, Ron is. But it's a challenge dealing with the stakeholders on both sides here, really it's pinched.

MR. RUDLAND: And, again, I had to give as many options as possible so that a deterministic analysis is an opinion. They can do probabilistic analyses as an option. They can do the inspections as an option.

So, they have a variety of different options to choose from. Whatever --

MEMBER MARTIN: Well, true. Obviously you've elevated a couple options here. But the two

NUREGs, and of course you had the slide earlier where, you know, you, you had the stakeholder, the industry stakeholder engagement and you pick Option 2. And I don't think everyone here is, you know, completely a fan.

But, of course, as you know, you opened the door for other options. I just wonder if we don't find ourselves in a position to say -- and this is just opinion by one member -- but why not have, like, we originally did with Reg Guide 183 where, I'll say it aloud, we kind of held our nose to Reg 1 and said get to Reg 2. I mean, we may find ourselves in a situation here where, you know, Reg 0 is an improvement.

But maybe we need to, you know, you might recommend that we continue and get to a better place with more insight. And maybe requires more research, or more engagement, or something, but they still seem burdened which may not be completely justified under the umbrella of risk informed.

But there's some just skepticism as more of a comment than a question.

CHAIR BALLINGER: I think I need to make sure that we understand that this is a draft guide that it's recent, let the cat out of the bag, if you will, about workshops and the like. So, that the final rule that goes out for public comment is a ways away. And there's a fair amount of work to be done.

MR. RUDLAND: Yes. And, again, like I mentioned, the staff tried the best we could to provide as many options as we could in a risk-informed manner to be able to meet this. It wasn't like, it wasn't like -- like the, like the requirement or a recommendation. And again, the DG was always to be a sophisticated deterministic seismic analysis. Right? We wanted to make sure.

But, again, the inspection of these pipes that we're talking about are risk significant pipes. Right? We're not talking about insignificantly risk -- insignificant risk pipings we're talking about. We're talking about the reactor coolant piping; right? So, it's highly risk-significant.

So, we have to make sure that we are -- that we maintain the stability and the integrity of those, those pipings throughout.

MEMBER MARTIN: But it's not like we don't do anything now.

MR. RUDLAND: No, that's right. Right.

MEMBER MARTIN: The addition of the seismic failure analysis --

MR. RUDLAND: That's exactly why we have the inspection path. And, hopefully, it's not any large additional burden so that, you know, that they're able to cover that. You can't analyze it for seismic things and use factors.

MEMBER MARTIN: In criticisms I'm sure you heard it, but, yeah, anything new like this will appear very academic; right? And, you know, been in the industry long enough that it just ruffles feathers, you know.

Now, in many cases I think, you have a point, we're applied science here. There is an academic element and there are, you know, we've seen it integrated in, you know, 50.46 already to some extent. So, this is in addition. And at some point it's just what is enough?

And that's I think what ruled risk-informed in the first place is to come to some sort of consensus on how we have to judge that. And, yet, we'll still debate the uncertainties for that sort of thing.

MR. RUDLAND: And regulatory guides are only one way of doing that, so. That's the other thing. So, there may be other methods that we come up with during the public comment period or after the fact.

VICE CHAIR HALNON: This is Greg.

And I realize it's blasphemous to say don't worry about large break LOCAs anymore. I think we're having a hard time letting go, even though everything I've heard hasn't really convinced me that we need to do anything but let go, in addition to any kind of process on top of something and the work is more. It doesn't mean we get less, unless we eliminate, that's when it gets less.

But since I'm not an expert in materials or, you know, I'm an operator. So, I always look at it from a perspective is in the control room what difference is this going to make to me operating the plant? I mean, that's what I'm going to be listening for throughout the day here.

Right now they've been tying up my engineers doing a lot of work, inspections and analysis. I don't see anything that's of value yet to the operator.

So, and I realize that this is a design space and whatnot, but I just wanted to say I understand the seriousness of safety significance of piping. I was at V.C. Summer with the hot leg crack. I get it. And it still was complementary to this in the fact that we're still worried about our break

LOCAs.

And I just want to continue as you go through today and tomorrow, and continue to discuss it, help me understand what value, benefit to the operators I'm going to see. We're talking about more margin, operating margin, more margin here, more margin there, but that's in design space.

MR. RUDLAND: I think we, you know, in December talked considerably about what advantages come with approval of this rule. And we could go through those details again this afternoon or tomorrow.

VICE CHAIR HALNON: Yeah. We asked for an overview. What does this mean? And I think that we're going to catch that later this afternoon.

So, I'll ask the same question again to get it clear in my mind that to give you the reason I'm asking these questions, like, I'm not trying to push you to ignore large break LOCAs.

CHAIR BALLINGER: I keep trying to figure out how many of the plants would check the box "done" and not have to do anything?

MR. RUDLAND: Again, the inspections are the ones that are -- that I'm unsure about, that we need feedback from, from the industry.

MEMBER HARRINGTON: This is Greg Harrington.

Just both paths, 1829 and 1903, involve some determination of limiting locations. How similar and how different are the criteria for those limiting locations?

And in the draft guide they're talked about entirely separately.

MR. RUDLAND: Overall I think the topics are similar. But I think the systems that we're talking about, stress, material degradation, are all going to be about the same.

So, I would suspect that the limiting locations for 1903 would be the same as what we're talking about 1829.

MR. TREGONING: The only way they wouldn't is if you had some location that is susceptible to some very large seismic stress at a well, just because of where it was located within the piping system.

That would be the only distinction characteristic that I can envision that would lead to a different limiting location for sort of the 1829 versus the 1903 analysis.

MR. RUDLAND: But, again, we're talking about, like, for BWRs the hot light and the cold light. And those designs are different. There are some plants I guess they have some valves that hang off the steam generator, and stuff like that, and may impact the seismic behavior. But most of the time these are very straight, uniform sections of pipe. They're not going to be unique for the seismic.

VICE CHAIR HALNON: That's sort of where my head was at when I was reading this. And, yet, it seemed like, you know, like there was no, no connection between the two. And that seemed like an improvement that could be built into the draft guide to bring those together and note that there may be limited differences, but.

MR. RUDLAND: And I agree with that. The problem is that we're not necessarily privy to all the design seismic impacts on all the different plants. It would take, you know, an effort maybe for industry to be able to pull all that information together to make that determination.

CHAIR BALLINGER: Even these oddball plants, as you call them, with the valve hanging off somewhere, they've had to do a seismic analysis --

MR. RUDLAND: Yes.

CHAIR BALLINGER: -- to start with.

MR. RUDLAND: Yes, yes.

They necessarily had to do a crack type

analysis; right? They had to do some kind of design analysis, yes. They've done fragility analysis.

CHAIR BALLINGER: Fragility, sure.

MR. RUDLAND: But usually those fragilities do not consider, you know, possibility of reasonably-sized cracks.

CHAIR BALLINGER: Yeah, I keep coming back that those welds were mitigated.

MR. RUDLAND: Or if they're part of the inspection programs, which I don't know, maybe they are, maybe they aren't.

MEMBER HARRINGTON: Yeah, but not all the welds need to be mitigated. If there's no known degradation in the mechanism appropriate for that, why would you mitigate?

CHAIR BALLINGER: And then they would need --

MEMBER HARRINGTON: Yeah.

CHAIR BALLINGER: -- you know, a similar metal weld.

MEMBER HARRINGTON: No. Or we know they should --

MR. TREGONING: So, I just want to get back to Bob's point about and why we're even doing this. Right?

The whole premise for 1903, and really the essential question that we're trying to answer is we want to make sure that the risk associated with large break LOCA, which we already think is low, but we want to make sure that it's bounded by the 1829 evaluation; right?

Sort of that that risk is driven by the things that we deal with every day in normal operation mode. Because those are things that we have a better handle on.

So, the whole premise is that, with 1903, is then demonstrating that your plant's applicable to 1903, but if you do that you're able to demonstrate conclusively the seismic risk is not a consideration.

So, that's, that's really the essential question that we're trying to answer here. Just we're trying to have a demonstration you don't have to worry about effect due to these relatively rare 1 to the minus 4, the 1 to the minus 6, whatever number you want to put on it, but that these rare larger seismic loads that are above the safe shutdown or it's played through ESSC loading that's part of the design basis already.

So, that's, that's the question we're trying to answer. Yes, we want to do it in a way that plants can answer it with a minimal amount of burden.

So that's, and that's -- you said, did we get that right? Well, probably not. But that's, that's the objective.

Okay. I don't know, can we move on?

I guess I'm on.

All right. So, I'm going to talk about the last facet of 1829 -- or DG-1829? Got that on the brain.

DG-1428, right, there's three pieces of it: 1829 applicability, 1903 applicability, and then making sure that when you do plant changes they don't invalidate any of those previous invalidities.

Now, the thing that we struggled with with plant changes is 50.46a is a very broad rule. But you can make any change to the plant as long as you can demonstrate that you meet the change criteria. So, basically, through the PRA requirements that are detailed in the rule itself. And then what we talked about in December in 1426.

So, there's a broad suite of changes that can be made. And there's a recognition that the large majority of this, those changes will have nothing to do whatsoever with the 1829 or the 1903 analyses.

If you're going to change your diesel

generator maintenance requirements, and you're allowed to do that because of this rule, it has no bearing whatsoever on the 1829 or the 1903 analysis; right?

So, that's, that's this trouble.

However, you could do other things; right? You could incorporate, you could go in for something like a power uprate. You could maybe increase my operating temperatures. You could increase flow rates.

And those things may potentially have an impact.

So, when we were trying to figure out how to assess plant changes, just recognize that it's challenged by the fact that, you know, under 50.46a there's really no limit, other than from a risk perspective, the types of changes that can be made.

So, the hope would be that if your changes, if any of the changes aren't applicable to those 1829 or 1903 analyses, then that's the extent of your plant change evaluation. Basically, you document that and say this is why there's no impact. And then you move on.

But then we also tried to accommodate the fact that, well, some plant changes might have an impact. And the thing that we leaned on the most --

and I think you'll see that in the guidance -- is we said, well, what, what is the biggest possible change that we think that a plant could make under this rule that we would need to be worried about?

And then, you know, we sort of settled on power uprates. That was something in 50.46a that, you know, we knew a lot of plants could get benefits out of that. If we do power uprates, if there was anything that was going to have an impact on, you know, LOCA frequencies it could be power uprates.

So, we modeled a lot of the plant change guidance on existing guidance that's in place for reviewing power uprates.

Now, look, if a plant's going to come in for a power uprate they've got to come in separately for that anyway. So, if they're coming in separately for a power uprate, this wouldn't be a different analysis that would be required. This would be part of that analysis. At least that's how we would envision it.

But we tried to draw heavily and leverage from that existing guidance in developing this guidance. So, what we did when we looked at that, we said, all right, let's look at those things in the power uprate guidance that could affect the systems that could lead to breaks greater than the TBS. Just recognize that the draft guidance only applies to breaks in systems that are bigger than the TBS. Everything else remains within the existing design basis.

So, that's really -- and I don't want to go through the flowchart. These flowcharts make it look, I think sometimes, more complex than it is. But I'm a visual person, so I like having the flowcharts so that people can sort of peck their way to get through this.

There's really a couple of different ways, you know, this is the common theme, multiple different ways to get through this guidance and demonstrate that your plant change is okay. And it's no different with this section of it.

We can do a direct evaluation that your plant change doesn't upset anything that they did in 1829 in terms of any of the variables associated with things that cause LOCA. And those things are identified in these variables to consider block.

And those are also the same things that would affect the 1903 evaluation in terms of your plant's susceptibility to failure under a rare seismic event.

So, you can directly assess the effects on those, on those variables. Or you can, or you can use this analysis using the review standard for extend power uprate. And there might be a few specific standard review plan areas that need to be addressed.

So, all of the boxes in this, in this technical area to consider, those are all areas that are covered by an existing standard review plan that would be appropriate for systems that are greater than the TBS.

So, that's one aspect of it, you know, for evaluating effects on direct failure.

And then there's a couple of things to consider for indirect failure. There's prior indirect failure analyses that the plants already do or already have in hand to demonstrate compliance with GDC-4. And those are things like making sure that the systems are adequately protected against missiles and dynamic effects of fracture.

So, so those are things that already, you know, these evaluations should already exist. And one option is to make sure that you've done nothing to call into question that existing basis as a result of the plant change.

If you don't want to leverage your existing analyses, you can also with indirect failures, as with direct failures, do a more direct evaluation of how your plant changes has affected some of the variables that would make it more likely potentially to be impacted by dynamic effects for missile protection.

So, that's the flowchart in essence.

Next slide, please.

I'll go through this in a little bit more detail.

So, I think I've covered this. You know, the whole point of this portion of the reg guide is for plants to demonstrate that their changes do not, or their proposed changes do not significantly increase LOCA frequencies.

They have to consider both direct and indirect failures.

And failures under not only normal load, but then also these rare seismic loadings as in 1903 should be considered.

And then the other thing to take into account, as with these other analyses, is to just make sure that you're accounting for age-related degradation.

And then, again, as part of 1426 they're already required under the, under the current proposed 50.46a to do a risk-informed evaluation to demonstrate that the plant changes don't significantly increase LOCA frequencies.

Next slide, please.

So, in terms of plant changes and LOCA frequencies, again they need to demonstrate that they don't -- There's, sorry, a couple different options here.

Again, and the whole purpose here is to demonstrate that you have continued applicability to both reg 1829 and 1903.

Option one is to directly evaluate the effects of the change on those variables that are most important that affect both the frequencies that are articulated in 1829. And these are things like, you know, did the change affect the plant materials, the environment, the loading, degradation rates, the geometry, and then either the maintenance or the mitigation practices associated with that particular system?

So, that's, you know, that's, those are some of the -- those are the prime variables.

And then you want to make sure that you at least assess if that change is going to introduce a new degradation mechanism that maybe wasn't previously in place.

And we've seen this in the past; right? We've seen it where, you know, you've had power uprates and they've induced vibrations in systems that weren't there before.

And then you've had enhanced susceptibility to fatigue, vibration fatigue.

So, it's all sorts of things that you want to make sure that the plants are aware of, and you're considering when, you know, when they're thinking about implementing a particular change.

And then the other thing they have to do is they have to assess to make sure that the performance monitoring that they're doing on that system will remain acceptable after the plant change. And then they just have to describe what that performance monitoring system is.

Again, if there's no changes to degradation rate -- rates, or no new mechanisms, then they're no reason that their performance monitoring that they're doing already shouldn't remain effective.

The other option, if they don't want to look at the direct effects on the NUREG-1829 variables, is to sort of lean on that review standard for extended power uprates.

And, again, we've sort of pulled out some of the guidance that's already existing for conducting these EPUs and reviewing them. But it's focusing on those things that, again, that are -- that relate to plant robustness against failures that are beyond the TBS.

So, it's things like making sure your RPV surveillance program's not affected, right; that your P-T limits having been changed or modified any way; that your upper shelf energy, PTS requirements, leak-before-break, piping materials and supports, chemical volume and control system, all of these things that, you know, could affect susceptibility in these large systems are not changed in any meaningful way.

And if you follow this option, you still have to also assess and describe performance monitoring.

CHAIR BALLINGER: So, again, this is Ron Ballinger again. Plants that have done an EPU, PWRs, they've already done this pretty much. In other words, is the form any different?

MR. TREGONING: Well, again, again this would only come into play if they're going to do, if they're going to do another EPU that relies on this new rule; right?

CHAIR BALLINGER: But it's the same -- are you doing anything have to go against?

MR. TREGONING: No, no new guidance. Again, we're trying to leverage existing guidance as much as we can. They've talked about leveraging existing programs, guidance. So, all of this is sort of standard, you know, rote evaluation that they would have done as part of an EPU.

Next slide, please.

Then with respect to 1903, this is similar to the 1829 evaluation. They just have to verify that they changes they don't have any impact on any inspections that you're doing at limiting locations;

Making sure that the changes don't increase the degradation rates.

And then you just have to verify that the analyses that you did to demonstrate that the seismic risk was acceptable is not, are not invalidated in any sort of way, so that the stresses don't change. Again, that the aging of the components doesn't get worse, just to demonstrate that the analyses that you did previously to demonstrate that your plant was applicable for 1903 has not become, has not become invalid.

Next slide.

And then, finally, then the last piece of it is making sure that your indirect failure frequencies haven't been impacted in any way. And, again, these are largely governed already by the GDC-4 requirements.

And, so, really you just have to demonstrate or document that you have continued adherence to GDC-4; right? And there's, you know, GDC-4 talks about dynamic effects as well as missile protection.

There's two options for doing this. You can just demonstrate that your prior analyses were unaffected by the plant changes that you're proposing; and that your existing analyses remain sufficient.

Or, you can supplement those existing analyses or conduct new analyses, if those are needed. And there's existing guidance already in place if that, you know, if that level of evaluation is required for any sort of plant changes.

We've already talked about, Se-Kwon talked about indirect seismic failure risk. That's going to be governed under the change control process that's already been delineated and described in DG-1426.

So, that guidance would be levered when making sure that any plant changes that you have will not have a demonstrable impact on the risk associated with indirect seismic failures.

Next slide, please.

We have a slide on appendices because, again, there's a recognition -- you know, Bob said this is, some of this is academic. And, yeah, it certainly is. It's rare seismic events, it's very much of an academic analysis.

So, you know, if plants need to go to that route, we try to provide much help along that lines as possible.

So, in Appendix A we've provided all the information that we used in 1903 to do the plant-specific evaluations that were done in 1903. And recognizing that those plants could hopefully, not only those plants but other plants potentially could leverage that information.

So, Appendix A basically applies a lot of the information that plants would need to gather or get together as part of doing the seismic analysis.

And then Appendix B is just a sample problem. Say, okay, if you have to do a sample problem, use a critical location. We're going to work through it on a particular location, under a particular load, and with a particular material. So, it's a step by step calculation approach.

So, we retained those appendices. We

debated whether to keep them from 1216 and move them into 1428. We thought, you know, we're going to put them out in the draft guide, get feedback from industry if they think that sort of information is going to be useful or not.

And then if we agree that it's not, then, you know, that will another way to streamline the reg guide before it's finalized. But at least initially we wanted to make sure that that information was available.

Next slide, please.

So, this is really the last slide. So, since I went last, I get the opportunity to summarize, which I greatly appreciate.

Again, we've talked about a lot of this. But really the evaluation is there to support the requirements in the rule to demonstrate that breaks greater than the TBS remain unlikely.

And there's two aspects of that, not only direct failures but then indirect failures. Right?

And so DG-1428 provides the guidance necessary for conducting these evaluations.

As I mentioned previously, we didn't start with a blank sheet of paper, we started from 1226 and modified that as we thought was appropriate. We tried to streamline and simplify it as much as possible.

But I think there's a recognition that, sure, there's additional streamlining and simplifying that could be possible. Certainly with this, DG-1428.

We also increased the scope, as Dave talked about, to make sure that we included some guidance for addressing indirect seismic failure in this guidance. That was something that we agreed to do to address prior ACRS comments from back in 201.

We did receive very few comments on DG-1216 during its development. And that, that helped us, I think, 1428, it helped focus us and at least, hopefully, helped iterate, to triangulate to where, you know, this final guidance might ultimately end up being.

I think there's a hope and expectation that once, assuming that DG-1428 goes out for public comment, that we'll get similarly very good and constructive public comments that we'll be able to use in refining this guidance and, ultimately, you know, hitting on the final guidance that will be associated with this rule.

As we've talked about, really ad nauseam now, we've not only leveraged 1426, but we tried to leverage as much as we could other longstanding guidance as well as applicable industry programs. And Dave talked a lot about that.

And on this third bullet, you know, there's a lot of options or graded approaches. You know, you might say it's overly complex, we've got too many options. But that's okay, we thought, at least from my perspective, we thought having better -- more options was better. And then we can winnow those down based on what we think those options that are going to most useful and helpful for the industry moving forward.

Reg guides provide one acceptable way. We feel like if you looked at all the different permutations, we've probably provided about a thousand different ways people can demonstrate applicability through these various options.

But we can talk about flexibility. If we can support it, we think that's important because not every plant is going to be in the same situation.

And if we knew where every plant was in this space, then we could tailor guidance appropriately. But that's just information that we don't have.

And then, as Dave talked about, no differently than we were going to do with 1216, you know, once we get this out there, assuming we get it out there for public comment, we'll immediately start engaging with the other stakeholders.

We really, you know, we planned this in 1216. We'd like to propose it now. We're really hoping that we do at least one pilot study, maybe even more than one pilot study if a couple of plants are interested.

We know that that's a big burden to get a plant to want to volunteer for a pilot study. So, I don't take that naively or lightly. That's a big commitment. But we think it could really provide some value because one of the things the staff struggles with, again not having coming from an industry perspective, we know what we think the staff needs to see. And we think we understand, at least at a high level, what the implementation burdens are. Until you actually work through it, you really don't have a good sense for what those burdens really are.

And to try to find out where the hard spots are and say, okay, if that's a hard spot, how do we get around that hard spot in a way that we still think is going to leave us in a good place in terms of making sure that the TBS remains applicable and valid for those -- that particular plant.

So, that's really it, I think.

Next slide's acronyms which, you know, Lord knows we used plenty of acronyms, as we always do in this presentation.

MR. RUDLAND: There are a couple extra slides at the end. And basically it's just the details in the rule where DG would be applicable. So, it's just a bunch of words with the actual, the actual proposed rule call-outs so that you can see what is correct.

CHAIR BALLINGER: Thank you.

We're actually only 1 minutes behind, well, 12 minutes behind schedule. So, we're scheduled for a break.

MR. RUDLAND: Dave has a question.

CHAIR BALLINGER: Yeah.

MEMBER PETTI: This is Dave. Rob and Dave, so, let me -- I'm trying to formulate the question. But as I look at everything I get a sort of sense that there were bounding conditions allowed in the rule and the guidance, most of it related to the inspections the plants do, the amps, their tech specs, this need to maintain regulatory control of large break well failures even though it's not beyond design basis.

And the thought process is, okay, what do we have to do? Well, yeah, they can use, they can use, they can use all these things.

I'm thinking about the problem the other way. If industry came in, is there a way to use the rule and the guidance to make changes and reduce burden in the areas of inspections in terms of amps?

You know, what does the rule do to any of the amps that are out there, and tech specs? My favorite is let's change the diesel generator start time tech spec because this is beyond design basis LOCA. Why do I need it to start so quickly?

These things are running through my mind and I haven't heard anybody talk about, you know, where this can go. Because LOCA's everywhere in the rule set. Have you guys given any thought to this?

So, this may be appropriate for our broader discussion at the very end when we think about that.

MR. TREGONING: We think about that all the time.

MR. RUDLAND: As a regulator, those are things that we're concerned with. As a regulator, it's those things that kind of make you sweat, but we don't really know what the possible future implications are for -- from this rule.

So, we're thinking about that constantly. You know, we think about that constantly. And we've had discussions internally about where we think the licensees may go once this rule is in place.

And, you know, it's difficult to tell. And it's something that I expect that we will talk about during this public interaction period after the proposed rule, you know, that to figure out exactly where they would want to go with this.

Now, back in, you know, the mid-2000s when we were originally working through 50.46a we had a lot of workshopping with industry. And that was a broad enabling one as well.

So, they indicated some things that were important to them. Now, some of those things since that time they've been actually able to achieve through other means.

So, there is certainly uncertainty in terms of what plants and stakeholders might want to achieve with this rule. And that's something that we certainly, we're certainly interested in.

Some of the big ticket items like power uprates remain on the table, though. We're certainly aware of that. But, yeah, you could concoct a lot of things that could be done with this rule.

MR. TREGONING: Especially, you know, if there are future reactors that are similar that it could in fact affect, you know, the design or the original licensing basis and such like that, or the area like the ECCS and such. So, yeah, those things are on our minds.

MEMBER PETTI: Okay.

CHAIR BALLINGER: Okay. So, now we're at 1:16. I'll call it 1:15. Let's take a break until 1:30.

Thank you.

(Whereupon, at 1:16 a.m., the above-entitled matter went off the record, and reconvened at 1:30 a.m.)

CHAIR BALLINGER: Okay, we're back in session. We have a slight modification to our agenda in that we're going to, on Agenda 6, if you have the agenda. The changes to the rule since the last subcommittee meeting we had in December. That's going to go now. And then any additional follow-up, we'll have a discussion with that.

And then we have -- we think that we're going to -- if you look at Item 7, there's a follow-up discussion. There's a list of topics and the staff has asked that the TBS size discussion also be part of before-lunch discussion. So unless members have additional comments, that's the way we're going to proceed. So I think -- I don't know who the presenter is.

MR. MESSINA: Me, Joseph Messina.

CHAIR BALLINGER: Yeah.

MR. MESSINA: Yeah, so, hi. I'm Joe Messina in the Nuclear Methods and Fuel Analysis Branch in NRR, and I just have one slide this morning to talk about some of the -- a couple of the changes that we've made since December.

We thought it was important to get this in before lunch in light of the industry presentations that we saw. So maybe this will limit some of the -- reduce some of the discussion in -- by industry, so.

CHAIR BALLINGER: I got a bridge to sell you.

MR. MESSINA: So the two changes are on the slide. The first one was there was a requirement that any of the non-safety-related equipment credited for LOCAs above the TBS be placed in tech specs. And I have the, this first sub-bullet is the wording that was originally in the draft proposed rule. But we have since removed it in concurrence.

And then we state that, you know, licensees should consider on a plant-specific basis whether they should be included in tech specs according to the current requirements under Criterion 4 of 50.36c(2)(ii). And so --

VICE CHAIR HALNON: Joe, this is Greg. Can you just tell us what that criteria is?

MR. MESSINA: That is the criteria that -- equipment that's important to plant safety based on the operating experience or the risk has to be placed in tech specs. So this is used for some of the justification for placing some of the ATWS equipment that's credited into tech specs.

VICE CHAIR HALNON: Okay, so it's not just a play on words, you actually can eliminate or not have to put this non-safety equipment in tech specs. You don't have to do it. There's a criterion that -- it doesn't just --

MR. MESSINA: There's a criterion that, yeah, is not a new, not a new analysis. They would just do it under their hazard they currently do, yeah.

MEMBER HARRINGTON: And so this is Craig Harrington. And just to be clear, the first sub-bullet is what's -- what was originally --

MR. MESSINA: Yeah.

MEMBER HARRINGTON: The second sub-bullet is what it's being replaced by.

MR. MESSINA: The first sub-bullet was

originally in the rule that we sent you guys in December. The second sub-bullet is in the -- in the preamble. That first sub-bullet was struck completely, not --

MEMBER HARRINGTON: So we're just left with --

MR. MESSINA: Yes.

MEMBER HARRINGTON: The second.

MR. MESSINA: And then the second change was we had changed the LOCA definition from breaks in pipes in the reactor coolant pressure boundary to breaks in the reaction coolant pressure boundary.

We placed end pipes back in to align with the current 50.46 definition. Because we think we need to evaluate that a little more and consider if there are any unanticipated effects of that change as we -- yeah.

And that's all I have for the change.

VICE CHAIR HALNON: Joe, this is Greg. When you took the -- when they took pipes, end pipes out, what did you have in mind? Flange condensed break, you know?

MR. MESSINA: So that was mainly -- we made that change not -- with the anticipation that we would not affect the operating fleet at all, but that it would be to -- for future reactors. Because some of these reactors, the designs are different, and you know, they have long, cylindrical things that move fluid, and maybe they don't call them pipes. So it was to avoid legalistic arguments.

MR. RUDLAND: Greg, this is Dave Rudland. I can also say a lot of these analyses that were done in what we're talking about, for the TBS 1829 and 1903 focused on breaks and not just breaks adjusted pipes, so we looked at a lot of non-pipe leak breaks also in determining those LOCA frequencies.

So that was one of the reasons why we undertook that. But it does need to be consistent with, you know, the code of regulations.

VICE CHAIR HALNON: Thanks.

MR. TREGONING: Rob Tregoning, just to add a little bit more onto that, there was a -- when we did 50.46a, and like Dave said, we looked into non-piping breaks, that was a very significant part of the evaluation. And it was just a recognition that the LOCA is any sort of rupture of the primary coolant pressure valve. It doesn't necessarily have to be in a pipe.

So that's why in 50.46a, we had originally not included piping. And then at the time, we said, well, let's go back and make 50.46 consistent so that we have consistent LOCA definitions in 50.46 versus -- and 50.46a.

But like Joey said, I don't think we really appreciated some of the potential regulatory implications associated with that. So that's why we've ended up putting back in pipes into both definitions so that they're consistent, recognizing that there are some challenges to making sure that everyone can agree on what a pipe is and isn't, so.

MR. MESSINA: And that's all I have.

MEMBER MARTIN: This slide is just changes to the rulemaking document and not to the draft guides, is that right?

MR. MESSINA: Correct.

MEMBER MARTIN: Are there any significant changes to the draft guides that are worth talking about?

MR. MESSINA: I don't believe we made any significant changes to the draft guides since December. You've received -- there were some changes to the, I think the risk-informed guide, but that was discussed in December and we've since sent that revision to the ACRS.

MR. WANG: Yeah, we have it.

CHAIR BALLINGER: Yeah, and I think you put those new documents, if you hold the new side by side, there's really no substantive change. What is it, 1426?

MR. WANG: Yes, that's what Joey talked about.

MEMBER MARTIN: It was 1426, I had asked for that last month. And I guess I'll look for it this year. I didn't know we had an update yet. Just kind of delta document.

CHAIR BALLINGER: Okay, now we're --

(Simultaneous speaking.)

VICE CHAIR HALNON: I think Dennis has his hand up.

CHAIR BALLINGER: Okay Dennis, proceed.

MR. BLEY: So at least in the PRAs, if people look at the reactor coolant pump seal LOCAs, I guess we can't call those LOCAs anymore?

MR. MESSINA: We're not anticipating on changing how we're treating LOCAs in 50.46 in terms of what the break is considered to be.

MR. BLEY: Fair enough.

MEMBER KIRCHNER: This is Walt Kirchner. I just volunteer that the existing 50.46a has a much more generic definition for specifying the breaks that are analyzed. And that fits in with Dennis's comment.

MR. MESSINA: But we changed it to include the end pipes because to be more specific to align with what's currently in 50.46.

MR. RUDLAND: I think his comment was that it was originally more generic.

MR. MESSINA: Yeah.

MEMBER KIRCHNER: Yes.

MR. MESSINA: In December it was more generic and now it's now it's more specific again.

MR. BLEY: So I don't know, I understand what you did and why you did it. But does this somehow limit applicability to some of the new designs we're going to be seeing?

MR. MESSINA: No. We do not expect it to limit applicabilities to some of the new designs. For example, some of the new designed reactors are using the current 50.46, which has this definition of breaks in pipes in the reactor coolant pressure boundary. And we, you know, we're working with them to address LOCA.

MR. BLEY: Okay.

MR. MESSINA: The difficulty with new designs is to define exactly what "pipes" means. You know, I think that's the things. You know, in some cases they may have a forging and is that a pipe or is that not a pipe and stuff like that. So I think those are some of the discussions that are ongoing.

CHAIR BALLINGER: Other questions? Okay, we're about to enter the grey area. We had, the committee had, after the December meeting, we got, had communications, and we had identified areas that we might need a little bit more clarity on, discussion, the like and stuff. And those concerns were codified in a -- in a paper, which is in ADAMS, which delineates the various areas that the comments were in related to the rule.

And those areas include the items in number 7 here, one of which is TBS size. And we had thought that this afternoon, that discussion that we would have would be related to those areas and the staff was planning on being available for doing that.

But the staff has also asked that the TBS, which is item No. 3 in our list, get moved back up into the discussion we're having now, because Dave has is already -- they're still here, so we might as well just ping him a little bit more. But that's a discussion with the committee.

And so that's -- we'll save the rest of the discussion until after lunch. But are there comments or discussions we have to have among the members and consultants related to the TBS size discussion that we pretty much had most of the morning?

So I guess we just need to open it up to discussion among the members. If there are no comments or issues or discussion topics, then we can just move on.

MEMBER PETTI: Ron?

CHAIR BALLINGER: Yes, sir.

MEMBER PETTI: This is Dave. Just to tell the other members, if they hadn't seen it on SharePoint, I collated all of the comments into those bins that are showing on the slide, except for stuff that's more administrative or editorial. So the staff kind of knew in advance what some of our concerns were.

But that doesn't of course stop us from going somewhere else with the discussions. It never has. But I didn't, I particularly didn't pick up any administrative things in the language, so feel free to bring those up.

But I thought I'd tell you the three that I picked up. And they didn't know -- I did not say who made these comments, so I just expect members to carry the ball, they should recognize them. In some cases more than one member made the comment, which is why I also put it on the list, because that means, you know, there's some consensus.

The first one is a comment but not a, I don't know one that needs a lot of discussion. I think we'll probably say in our letter that the technical basis for TBS is strong. You know, we have the expert elicitation and the seismic risk work that was done and then now the probabilistic fraction mechanics. So it, you know, I think it's a fairly healthy technical basis.

That said, there's a whole discussion about inspection of piping above the TBS in light of the fact that, you know, it is now considered beyond design basis. And so it's the same question that Greg raised earlier that we're talking about, you know, is there an internal consistency there in terms of the inspection schedule relative to the risk that we're talking about.

And then the last one I had is analysis of LOCAs beyond the TBS. You know, there's still requirements for containment analysis and defense-in-depth, and so there may be some discussions there that members had. Those are the three that we had, so.

CHAIR BALLINGER: Okay, that's a good basis for the start. Did the staff have -- I mean I don't know that you need to respond or anything, but feel free to do though.

MR. RUDLAND: Well, I'll touch on the, start with the inspection.

CHAIR BALLINGER: We beat the inspection thing to death.

MR. RUDLAND: Yeah, I just want to make a comment about that again. You know, the idea that we have done these analyses that make a demonstration that the piping that's greater than the TBS is a very low likelihood of failure does not -- it does not remove our need to be able to continue to verify that those analyses remain valid throughout the course and the life of the plants.

And so you know, while we do understand that the chances of failure are really low, we do think that -- we think we need to continue to monitor those things for novel degradation as well as a continued assurance of the accuracy of the analyses that we'll conduct.

VICE CHAIR HALNON: Are we inspecting them to the same level that we would have inspected them if we didn't have a TBS?

MR. RUDLAND: It would be inspected during, through the normal ASME Section 11 process.

VICE CHAIR HALNON: So what does it gain me from an inspection perspective?

MR. RUDLAND: It doesn't gain you anything. It's not meant to gain you anything.

VICE CHAIR HALNON: That's my point, is that we're pushing it -- it just seems like there's an opportunity for a graded approach relative to risk. I get to 10 to the minus 6, whatever. There's some going to be less than that, maybe significantly less.

MR. RUDLAND: But the gains are elsewhere, not in the inspection.

VICE CHAIR HALNON: Well, from an outage perspective and dose perspective, there's a lot to be gained from reducing the number of inspections if there's no changes, no changes in analysis, no change at the plant, no transients of concern. I could probably list a few more things.

Why not allow an inspection regime that says okay, I've done my ten percent or whatever is required, found no problems. If that gives me another 10, 15, 20 years rather than continue to inspect at the same level as if it was a design-basis event.

MR. RUDLAND: And again, that's the whole philosophy behind these risk-informed programs, right.

So they're -- they have received the credit for the fact that there are locations within the piping systems that are low risk. And that -- and so they're only inspecting those higher risk locations. That's part of the risk-informed program.

So what we're asking for them to do here, just include these particular welds or a sampling of these particular welds into that program.

VICE CHAIR HALNON: They're already in the program.

MR. RUDLAND: Well, the piping groups are, but not necessarily those particular welds, right. Because the piping groups we're risk-informing are a much bigger sample, much bigger population of welds than those welds that are greater than the TBS.

CHAIR BALLINGER: So I'm coming back. If the plant is in compliance with Section 11, what else do they need to do? They're already inspecting the welds that are in Section 11.

MR. RUDLAND: Right, the only requirement difference is that they need to include these particular welds in their sample, or a percentage of those in their sample, in their inspection sample.

CHAIR BALLINGER: So what you're saying is that some of these welds are not part of Section 11.

MR. RUDLAND: No, they're just not part of the sample. Section 11 is a sample group.

CHAIR BALLINGER: Yeah, yeah.

MR. RUDLAND: So you inspect a certain percent --

CHAIR BALLINGER: Oh, oh, I see, okay. I get it now.

MR. RUDLAND: So typically for the Class 1 piping welds, a typical Section 11 program is 25%. You have to inspect 25% of the welds. The risk-informing programs allow them to reduce that to about 10% but only look at those really important welds.

CHAIR BALLINGER: Okay.

MR. RUDLAND: So what we're saying here is take the welds that are in, that are greater than the TBS and make sure 10% of those are included in your program, of a sample part of your program. And that's consistent --

CHAIR BALLINGER: Eventually in Section 11, that weld will get inspected anyway. It just might not be for a long time.

MR. RUDLAND: It may never get inspected.

MR. MESSINA: It's not part of their inspection sampler, it never gets inspected, ever.

VICE CHAIR HALNON: So the logic, help me with the logic. You're taking a 10%, which are all very important welds, and you're putting some unimportant welds in it --

MR. RUDLAND: No, I'm not saying -- they're not unimportant welds. That's the whole point.

VICE CHAIR HALNON: But they're not in it.

MR. RUDLAND: They're in the thing, they're just maybe -- I don't know if they're in it. That's the point. They might be in it, because that's --

(Simultaneous speaking.)

VICE CHAIR HALNON: I follow you, Craig, I'm just saying --

MR. RUDLAND: That's a plant specific determination.

VICE CHAIR HALNON: It feels like you're displacing some very important stuff, that you've already determined is very important.

MEMBER HARRINGTON: I get your point, but still, and I really struggle with this, the, you know, it's very presumptuous of us to assume that all of our analysis of degradation mechanisms and materials, all this work that we've done means that nothing will ever happen.

Because there are unknown unknowns. And we could be surprised. I don't expect us to be surprised, but if we don't look, then that surprise will find us before we find it. And that's not good.

VICE CHAIR HALNON: But the point that I'm making is that, and I don't want to sound flippant and, you know, negative safety culture, but it's almost a okay, so what. You have defense-in-depth, you have leakage detection, you have analysis that said it's not going to be a double-ended, you know, break.

You still have at least half of your safety systems that are still available because you have two trains typically, you only need one for the large breaks. It's very rare, you know -- I get to, almost to the point of so what. Not from a safety, I mean, and I'm not sure why --

MEMBER HARRINGTON: The inspection sample one way or another.

VICE CHAIR HALNON: Yeah.

MEMBER HARRINGTON: But it may well be that the inspection sample right now, and it may not. But it is possible that the inspection sample that they've chosen right now is chosen as much for convenience as it is for the distribution of sizes, for example.

CHAIR BALLINGER: Yeah, the cynical approach is plant owner says we needed to inspect x welds 25%

or what number, but weld number y-3 --

MEMBER HARRINGTON: You're not going to go inspect the hardest weld in the entire plant.

(Simultaneous speaking.)

CHAIR BALLINGER: We're not going to do that, we're not going to put that in this. But the rule comes back and says by the way, you need to analyze all these welds and you need to determine which ones are the most at risk, if you will. And you need to include those welds in the 25%, if they're not there already.

MR. RUDLAND: So if you talk about this particular category of welds in the risk-informed program, this particular category of welds is similar metal welds that have high consequence but no known degradation. That's the category of welds that we're talking about.

So if you think about what's driving those welds to be in the risk-informed program, it's the welds probably that have the highest stress and maybe the highest usage factor, right. They may have a teeny issue or something.

So the chances of a weld not greater than the TBS and a weld greater than TBS probably have about the same values for those criteria. It's not a question. They chose the other weld for some other reason. Maybe it's ease of inspection or they have other welds that they're inspecting that are in the same location, so when they set up their scaffolding they don't have to move the scaffolding.

There may be other things like that that are financial that may be driving why they chose welds other than those that are greater than the TBS. But there's probably not some big issue with degradation that we would be neglecting if they were to move one weld smaller than the TBS to one weld greater than the TBS in the sample.

CHAIR BALLINGER: But I keep coming back to those, most of those welds you would think would have been mitigated in some way.

MR. RUDLAND: Well, again, they're not instigated because --

CHAIR BALLINGER: Some way.

MR. RUDLAND: They're mitigated by the fact that there's no known degradation at this point. So their inspections are limited based on that knowledge.

MR. TREGONING: These are not in 770 welds.

CHAIR BALLINGER: They're not --

MR. RUDLAND: No.

MR. TREGONING: We said at the beginning, that's a small percentage of the welds we're talking about.

MEMBER HARRINGTON: 770 welds already have their own --

(Simultaneous speaking.)

MR. TREGONING: Can I -- Rob Tregoning, staff. There's -- this is totally analogous with what's done now, right. We approved risk-informed break exclusion region. That was an EPRI program, right. It's based on risk-informed ISI. But it's risk-informed ISI with a twist. It not only considers risk propensity, but it also considers the propensity of a high consequent component failure.

And risk-informed break inclusion region, the way that, the philosophy works is you have a sampling population that you do, just like with risk-informed ISI, just like the ASME program.

But it says that you need to retain some percentage of high consequence welds that you're inspecting, so that part of your inspection sample should make sure that you have at least some percentage of high consequence weld. That's all that we're saying here, and it's entirely analogous what we're already doing in other risk-informed inspection programs.

Industry's coming in now and looking at risk-informed high energy line break. Same exact principles, right. It’s a sampling population, but it makes sure that it elevates certain pipes or certain welds that have a higher consequence of failure to just make sure that you have a certain percentage of those welds in your inspection program. That’s all we’re saying here. That’s all we’re saying whatsoever.

Because we know the consequence of failure between a six-inch branch line made of stainless -- with a stainless steel weld is much less significant than if we had, you know, a main piping coolant line that would break with a stainless steel weld. Much different consequence of failure.

So that’s all we’re doing here, entirely analogous with what, and you know, consistent programs that we’ve been doing out with, you know, with that industry and the NRC have been -- that the industry has proposed and the NRC has approved.

MEMBER DIMITRIJEVIC: Hi, this is Vesna Dimitrijevic. I just want to help a little with this because I was part of EPRI risk-informed ISI team. So this is how it worked and how this changed.

So first it changed from 25 to 10 percent, and it was based to select the welds with the highest risk. Since these old welds lead to LOCA from the consequence point of view, this is the same approach.

So the only thing which contribute was the degradation mechanism, but then there is not too many, as somebody already said, degradation mechanisms in the Class 1, the piping. So they only couple thermal fatigue or something.

So the 10% of inspection were select in the areas where there is degradation mechanisms, there is some -- and other percentage was selected from convenience. And main goal was to reduce exposure during inspection. So this -- so usually we are talking here between 400 and 600 welds in the Class 1 piping, so we are talking about like 40 to 60 inspections.

I don't really have, even I participated over 30 of those, I really don't have a good feeling about what size this piping, you know, was. You know, was it bigger than TBS or not. How that was approved so fast is the main reason is that there was not really reason to, you know, to require 25% when there was nothing really found in the years of inspection.

So inspection intervals of 10, yes, and they always inspect same 10% of the welds. So this is what is the status currently with this risk-informed ISI. So I don't really see the benefits of adding these, you know, the bigger size welds. But, and changing current risk-informed inspection program.

But I mean, so the main thing is not just convenience. I am sure the convenience was battling reduced exposures during the inspection.

VICE CHAIR HALNON: Thanks, Vesna. I just have one -- I realized my question is not from the expert perspective, but so we have roughly 4500 reactor years of operation in our fleet.

Do you see a path forward in another 4500 reactor years to say large break LOCAs are no longer of concern above the TB if nothing has happened?

MR. RUDLAND: So when I was a little bit earlier in my career and my division director came to me, I had done an analysis for him. I took the CODAP database and I plotted the behavior of material degradation in the existing passive components. Showed him how it changed and how the industry's response to that decreased the occurrences.

And so he said to me, Well, tell me what the next degradation is. Tell me what's coming. I told him, I said I don't have a crystal ball. This is not going to tell me what's going to happen. I can only look at what's past happened. I have to have regulations in place to guard against those things that I just don't know.

So in the next 4500 hours, again, if nothing else happens, I would feel more confident. But I don't know if I would have --

VICE CHAIR HALNON: So your branch chief probably wrote on his little pad of paper D-I-D.

MR. RUDLAND: Yeah --

(Simultaneous speaking.)

VICE CHAIR HALNON: -- the unknowns.

MR. RUDLAND: I thought you were going to say D-E-A-D on his little paper.

VICE CHAIR HALNON: And just, you know, from where my head is at, and I know it's probably, again, blasphemy, but we've got a lot of years of experience. We've got a lot of material experience with existing materials and there's new materials coming out every day, maybe every decade.

My point is that in today's environment, with the maturity of our PRA and our risk tools that we have, the knowledge we have with a lot of operating experience -- and I realize some of the new reactors, we don't have that operating experience. The environment, political environment with Congress and in some cases the Commission is well behind making a bold change to our regulatory process going forward.

Why is not now the time to say defense-in-depth, linkage monitoring is enough, and let's not worry about breaks above TBS?

MR. MESSINA: Joe Messina. I first would say that this could be a stepping stone to getting there one day, this rule. Everything --

VICE CHAIR HALNON: That's why I asked about another 4500 reactor years.

MR. MESSINA: Yeah, it could be, maybe. But there's also a lot of work that we would have to look at that we don't have the time for in this rulemaking if we wanted to take out large break LOCA from complete analysis.

So that's a major change, you know, a lot of -- as some members have mentioned, there's a lot of intertwining regulations that are even, you know, have we considered them fully in this rulemaking people are questioning.

And so if we fully remove it, we have no control over that. At least with this, we -- when plants try to adopt this rule, we would be able to say oh, did they invalidate any assumptions of existing guidance when we're reviewing this. So we have that regulatory control that we've been saying over these large breaks still.

VICE CHAIR HALNON: That's a good answer. I just want to make sure there is an industry to be able to do that next stepping stone. Enough said.

MR. RUDLAND: I'm a materials engineer, you know, and so I think about it in terms of the materials. And we all know that materials age and damage happens quickly in life. You know, then there's an area where we're at pretty steady state and then there's an end where the material begins to degrade again.

And people always say, you know, where is that point where things start really falling apart at, and I've got to give it to the industry, because it's been their proactiveness in materials-related issues that have kept us, I think, at this steady state. And again, as long as their continued diligence moves into the future, we could have a very long time before anything bad happens.

If that's the case, that gives us a better basis for continuing that. But you know, as homeowners and as a, you know, a person that's entering his sixties, we know things fall apart as we get older. So we don't want to stop looking just because we think everything's --

(Simultaneous speaking.)

VICE CHAIR HALNON: -- 500 years, yeah, I get it.

MR. TREGONING: Rob Tregoning. Sorry.

CHAIR BALLINGER: Apropos of what Greg was saying, I mean, Appendix K provided what I call an ejection seat. If something really goes wrong, we got it, right.

But to me, we now have another ejection seat, and that is 1.45, leak detection. You know, apart from abject stupidity, which is I suppose possible, the chances of us having a rupture due to a leak that's not detected, I don't know what the probability of that is, but it's got to be pretty darn low.

MR. RUDLAND: So we look at that, you know. And again, I think the scary thing is these, I mean that is getting a little bit off topic, the scary thing are these stress corrosion cracks that can produce very long but shallow flaws that become critical before they leak.

So and that occurs more in small diameters than it does in large diameter pipes. So that's why the probability of rupture without taking credit for leak detection, you know, is much higher for small diameter pipes than --

CHAIR BALLINGER: Not that we are taking credit for leak detection.

MR. RUDLAND: I'm just making the comment, I'm just making the comment that it's much higher in low -- small diameter pipes than --

(Simultaneous speaking.)

CHAIR BALLINGER: Your analysis says, I read somewhere, that you have to have a very large through-wall crack from a circumferential crack before a rupture.

MR. RUDLAND: Yeah, that's correct.

CHAIR BALLINGER: Regardless of the size of the pipe.

MEMBER HARRINGTON: Or very large surface crack, it could be very large surface.

CHAIR BALLINGER: Yes, but --

MEMBER HARRINGTON: They're just very unlikely.

CHAIR BALLINGER: But the probability of it leaking beyond, well, not being detected because of the -- you're talking about a gallon -- very low leak rates that are now being able to detect it -- detect it. That's pretty darn low. It's got to be, again, very low.

MR. RUDLAND: Yeah, and I think of leak detection as our defense-in-depth against the analyses that we had and so yeah, I agree.

CHAIR BALLINGER: So we have this very low probability already event, plus we have leak detection.

MR. RUDLAND: But the leak detection was used as the basis for the low probability event. So you're double counting a little bit, you know. Because those leak detection probabilities are built into those analyses.

CHAIR BALLINGER: 1428 was the first DG that had leak detection in it. Of all the DGs that we've been reviewing, the first time 1.45 was mentioned was in 28.

MR. TREGONING: So Rob Tregoning, staff. Just a couple of things. Ron, to get to your point, yes, if a crack is going to -- if a pipe is going to, the mechanism is going to leak before it breaks, there's no -- I have zero concern about those sorts of failures because of leak detection.

It's the non-leak-before-break degradation mechanisms that are --

CHAIR BALLINGER: But what are they?

MR. RUDLAND: Well, SVC is one of those. We haven't degraded it, and we've seen it in operating experience. It can get long surface cracks.

CHAIR BALLINGER: Small diameter pipes.

MR. RUDLAND: Well, you can get long surface cracks in a large diameter pipe too, but they just don't get that long before they --

(Simultaneous speaking.)

MR. TREGONING: The Duane Arnold was a fairly big pipe that had very extensive SVC. Now, again, it was in a similar metal weld. But I mean, it was about 85% through-wall cracked over the entire circumference.

CHAIR BALLINGER: Yeah, it was almost a lawn sprinkler.

MR. TREGONING: And you know, this notion that big pipes can't fail is just, it's just a false narrative. We've seen big pipes fail, even in nuclear applications. Now, due to different mechanisms. We've never had a LOCA. But we've had fatalities due to large pipe failures.

CHAIR BALLINGER: FAC.

MR. TREGONING: Okay. Ron, we've -- internationally there have been hydrogen events, where we had detonation events that, you know. And depending on where the detonation occurred, in Germany they were very close to having LOCA.

This notion that you can't get a large break or that you can't get a failure that won't exhibit a leak a priori is just, I'm sorry, I don't agree with it.

CHAIR BALLINGER: Well, but Section 11, it's there for that reason.

MR. TREGONING: Section 11 is partially there for that reason. Again, Section 11 didn't address FAC, right. I mean, there was no FAC --

CHAIR BALLINGER: Well, it wasn't supposed to.

MR. TREGONING: Okay, that's what we're -- that's what we're trying to guard against, right.

CHAIR BALLINGER: You have to talk to Bindi Chexal or his relatives.

MR. TREGONING: Because again, I think there's a recognition that look, even though there's no disagreement that the likelihood of failure in these pipes is low. There's no disagreement. But the consequences if a failure could occur are significant.

Even though we've got plans in place, even though you have to do the analysis, if there -- if this happened in a plant, it would be detrimental, not just from potentially a safety perspective, but even from an optics perspective.

CHAIR BALLINGER: It doesn't event need to be a rupture, to be honest, it just needs to be a large break.

MR. TREGONING: You know, I mean, yeah. So I think, so you know, so making sure that we have sufficient performance monitoring in place to make sure that we're doing risk-informed changes and not risk-based changes is ultimately what I come back to at the end of the day.

CHAIR BALLINGER: So it comes down to a discussion of how much monitoring do we need, that's really what it comes down to.

MEMBER HARRINGTON: This is Craig Harrington, hi. I think that really is the crux of this. How do you set up a monitoring program that has the lowest footprint possible but gets you the most information possible, the most relevant information.

MR. RUDLAND: And we talked to the materials subcommittee.

CHAIR BALLINGER: That would be us.

MR. RUDLAND: Yes, in November was it, Ron? About that, right. And how we want -- how we propose to design those types of programs to get the minimum number of inspections that are needed.

MR. TREGONING: And to get to Greg's point, I mean, inspections are a great one, right, I mean, and you're like, well, if we have another 4500 years, would that be good enough. Of course, we're a learning organization, we're a learning industry, right. And inspection's been a great one, right.

We've reduced significantly the amount of inspections that have been done, especially over the last 30 years. And look, if we started doing something under this rule and we started to gather information, and the information tells us that, you know, maybe we don't need to do as many inspections, and maybe they don't need to be done infrequently.

We've got a history as an industry, and as a regulatory body of looking at the technical basis, looking at the evidence, and saying yes, there is a strong basis for maybe doing some relaxation. So none of these things are intended to be static. None of them are necessarily intended to be set in stone.

But you know, we want that evidentiary based sort of method moving forward to make sure that when we do make changes that we feel like at the end of the day, that they're appropriate to give us reasonable assurance.

This is right, Craig's right. I mean, it's really just -- it's the debate about how much performance monitoring is enough.

MEMBER MARTIN: This is Bob, Bob Martin. Your arguments ring a bell for me when I was doing severe accident. Yes, there was always someone that said you can do better. You know, you could put in more guardrails and what have you.

And then you're in this beyond-design-basis space. And the consensus eventually led to, you know, the SAMA, SAMDA programs, where you had cost-benefit analyses that were performed ultimately leveraging PRAs. Has that been done?

I mean, tabletop -- I know you've already said it would be great to have somebody go off and, again, volunteer to implement these programs and see where it goes. But it seems to me that this kind of argument has come before.

And it came down to okay, well, I mean we can make a judgment, you know, based on some sort of cost-benefit analysis leveraging PRAs, as opposed to just, man, it seems more deterministic from what I said earlier given the way we're talking about it today, even though we might label it risk-informed.

But there are methods that we already

considered, you know, when we were moving beyond the design basis, that lead to decisionmaking that seems very practical. You know, has that really entered the conversation prior? Looking at what other people have done that your other parts of the agency has accepted in this space.

MEMBER KIRCHNER: Ron, this is Walt.

MR. MESSINA: So, I'll say that we have, we've talked with a lot of people when developing the initial licensing pathways, alternatives that were presented in the reg base, including our friends over in the Division of Risk Assessment, and this, we ended up going with this option. But we did talk to some of the more people that do risk stuff.

MEMBER MARTIN: Right, right. But I mean, so when -- obviously not addressed in what we've seen. But if, you know, I'm looking down the road, someone comes back and goes, well, we did the cost-benefit analysis and it just doesn't beat the threshold that we would otherwise consider for something equivalent in a severe accident space.

Problem solved, you know? No change? I mean, would that be enough to go, what we've got is enough?

MR. MESSINA: I would also, I think it's

important to note that, you know, the operating fleet was designed to prevent a LOCA. If we're no longer designing for that LOCA, how much does that --

MEMBER MARTIN: No, no, no, you're taking it too far, right. We, you know, industry's been around enough, long enough. We've done a -- we have a lot of knowledge about, you know, what we do and why we do it.

And you know, with the -- since Three Mile Island, the expansion of our understanding of severe accidents as beyond-design-basis events has led us to policy that, you know, provides a, I would say, objective decisionmaking approach.

And you know, I think it can apply in this space as well, even though you're coming at it from a different direction, right. You're coming at it from what we've always done, and then here's, you know, maybe a new consideration for, you know, seismic failures. And well, okay, we also have the pressure of risk-informed. Where are we at with that?

Well, the way I see it, we've moved the line a little bit with TBS. And you've just entered this space that a lot of people in the severe accident world already understand and already have solutions for making decisions. It seems like we should be looking at how those methods can influence, you know, this particular question or these particular questions.

MR. TREGONING: Rob Tregoning. I think it's an interesting point, right. And it's a very valid consideration. But we're sort of -- you're entering into the policy realm in some sense there. And you know, so while I think the framework is there, I think you know, we would need appropriate direction and sort of you know, direction to sort of head in that area.

I certainly think it's possible, right. It's how important you think the risks are and how much you want to -- and how much mitigation you want to have associated with those risks at the end of the day.

VICE CHAIR HALNON: That's a Commission issue.

MR. TREGONING: Well, right.

VICE CHAIR HALNON: That's a policy practice.

MR. TREGONING: Well, that's why I think -- I think, right. So but you're right, we've certainly done it in the past. And we can leverage or lean on those past experiences if indeed we decide to do something similar here.

So it could be done, but it's not something obviously for me --

MEMBER MARTIN: It's out of scope, basically.

MR. TREGONING: Yeah.

MEMBER MARTIN: But.

CHAIR BALLINGER: Well, I think by the way that they're -- Walt had his hand up, or didn't have his hand up but started talking.

Walt?

MEMBER KIRCHNER: Yes, Ron, thank you. Notwithstanding all the, just I'll make an observation. We're not going to give up on the ASME code and inspections for the existing fleet.

How we do those and how we target those to, as I think Dave was pointing out, looking at the areas where a failure has the most consequence and tradeoff for then using TBS as the means for 50.46a valuations of ECCS I think is an important -- I'm not saying this correctly. Is an important -- that tradeoff is worthwhile because I don't think in looking at the big picture the next part of this puzzle is how does TBS influence increased enrichment going forward in the fleet.

So if we have an acceptable means for

implementing TBS, and if that requires targeted inspections, that may be -- some of them may be more difficult than those that we do for convenience or dose considerations.

I think that tradeoff is going to prove to be worthwhile. Because without the TBS, I have serious reservations about whether we can meet the expected ECCS performance requirements and prevent FFRD.

So that's my observation at this point. So I would be very interested at some point today, do we get to the 56a language, and specifically how TBS is in the regulation, the rulemaking. That to me is extremely important next step to look at for the committee.

We're just not going to give up ASME inspections for public confidence and for insurance purposes. So targeting those and addressing those high consequence issues that are the unknown in going away from double-ended guillotine break strikes me as a very intelligent move by the Agency.

MEMBER MARTIN: I think getting to what Bob was talking about, we had a presentation on Tuesday on the 10 CFR 53. And just thinking through how this compared to that, 10 CFR 53 you would start with essentially the PRA and go figure out how your licensing basis events screen out and you know, put your mitigations in based on that.

Here, because the plants were designed for the deterministic requirements and the design-basis LOCA, it's kind of hard to get there. Now, maybe in an ideal world, you'd take that Draft Guide 1426 and say that's good enough for anything, you know, that's enabled by the break -- the TBS rule and say just can we get there.

It's just a question of whether there's enough fidelity to the PRAs and enough, you know, understanding for the existing plants. Some I guess are better understood than the new plants. But you know, do you get there in terms of the equivalent safety with, you know, defense-in-depth as a substitute for maybe some of these deterministic requirements.

Again, one specific is the containment pressure calculation. Because right now it's based on the double-headed break using conservative assumptions. The rule would enable the containment pressure to be calculated best estimate for above the TBS, then TBS lower be a design.

So that would seem to have the potential of lowering the design pressure. However, the design pressure would allow for higher leakage because your tech spec requires the peak pressure to be maintained for 24 hours. That peak pressure goes down, you'd have more leakage.

So is there some, you know, counteracting degradation safety because you've released your containment. Well, maybe if 1426 would tell you that, it'll tell you whether or not you captured it all.

But again, it's taking on a fundamental aspect of plant safety for the existing plants. And whether you get there with a cost-benefit analysis, I don't know. I'm not sure whether that's the appropriate model or whether 1426 is the appropriate model or just how you get there.

That's where I think the example with Joe, he was talking about, is just the existing 10 CFR 50 is so based on the deterministic, you know, double ended guillotine break LOCA that extracting it out of the regulation would be very complicated. And that said -- To me, it's one of the major attractive points of the LS approach, which says well maybe that's worth taking on. That would be a lot of work. So let's not mess with the fundamental, you know, aspects of the regulatory structure, just, you know, focus on FFRD.

Anyway, it's maybe some thoughts. I think like everybody said, the -- I think the justification for the transition break size seems very well-founded. And the idea of having a different regulatory approach above the TBS seems perfectly reasonable.

It’s just how do you do that without, you know, blowing up the whole regulation? To me that’s where the biggest problem is.

CHAIR BALLINGER: More discussion?

MEMBER HARRINGTON: This is Craig. To Tom’s point, it seems to me that what’s -- this gets into the bigger discussion of the day. But it seems that going and removing large break LOCA from the regulations, that that’s a huge lift.

But the approach that’s presented in the draft rule doesn’t go remove it, it just starts to chip away at its role and does so in a, what seems to be a structured, thoughtful, controlled way with reasonable guardrails and tools around that.

VICE CHAIR HALNON: This is Greg again. I think certainly making a full blown removed large break LOCA from regulations is one way of doing it. But we’ve seen an a la carte approach in the past like for alternate source term aspects where you go in and you can change certain parts of your licensing.

I don’t think that -- or like for containment pressure, that was a good example. Containment’s designed to 60 psi. Well, other than maybe the integrated test that I do every 15 years that I have to pump it up to 50 instead of 60, it might be some savings.

But I’m not trying to change the design of the plant, I'm trying to change maybe certain aspects of my controls around that design that could provide me some cost-savings flexibility with no degradation in safety at all.

And my point is, you know, there’s ways of doing that. You don’t have to go through and revise every other regulation in Part 50 to do that. But you can make it an option and say hey, if you want to change this, you have a basis now to go and change it, much like we did with the ultimate source.

So the -- again, there’s extreme ways of doing it and there’s other ways providing benefit. And you know, I get the incremental changes over time. My point was we've got the environment now because of the new set of reactors coming in, trying to save the -- save, that's a good way of putting it. They’re trying to preserve the existing industry.

Now there’s a lot of capital, political

capital, behind making a bold change. And I get it that this is down the road a little bit, but it seems to me that as an agency, we would want to not just say yeah, there could be something next, but start working on that next, with a mindset that -- And I get it Rob, you got to -- you got to believe it can happen just because you don't want it to happen. And I don't want to, again, sound flippant on safety because it's not a necessarily a so-what. But we still have our safety trainings. We still have the equipment and the design in the plant.

We're not going to let low pressure injection phones get mothballs on it and say we don't have to use them anymore so we're not going to maintain them, we're not going to poke holes in a core flood tank because I only need one instead of two. You know, they're all going to be there.

But the operational flexibility, LCO times, outage time. Other things can be quite advantageous. I'm not suggesting that we don't monitor for the problem. It seems like this is a time to do some bold changes.

MR. MESSINA: I'll note that -- remember the schedule. We did not have a ton of time for the schedule. We tried to leverage existing frameworks, steps have been previously vetted and well-established.

VICE CHAIR HALNON: I think you guys have done a great time in -- great job. As a matter of fact, I've never seen this much work done in a short period of time.

MR. MESSINA: Thank you.

VICE CHAIR HALNON: From what you all have done. It's just rather than -- it seems like there needs to be a phase II, and we need to start working on that as well. And given two years, three years, four years down the road, I don't know what the answer is there, but at least acknowledge it and go. And then say maybe.

CHAIR BALLINGER: More discussion?

DR. SCHULTZ: I'd just make a comment, and that is that as we've just discussed here, that this in fact in terms of a risk-informed approach, which is all of what we've been talking about here, this in fact is a bold move.

And as was mentioned by Walter, retaining, retaining the inspection capability and responsibility by the existing fleet is an important piece of that when you think about dealing with not just those that want to move forward with removing the event, but dealing with those that wonder why we are able to make this move.

And to retain the inspection capability that has been established and the monitoring capability that has been established is important. But part, I think, of explaining why are we able to take this approach and allow a lot of different improvements to be made to the overall system in a risk-informed way.

CHAIR BALLINGER: And the reason we're able to do this is because of the last 20 years of research addressing issues --

DR. SCHULTZ: Exactly, we're taking full advantage of that.

CHAIR BALLINGER: Again, just to not do that would be almost stupid.

DR. SCHULTZ: I agree.

CHAIR BALLINGER: We ought to do something like that. And the only thing that changes slower than the Agency is probably the ASME code. So to think that all of a sudden Section 11 is going to allow no inspections? Not happening.

MR. RUDLAND: I would say it's not going to happen, but they're moving towards that. Because in a lot of cases, they are changing inspection frequencies, right, so that there's longer time between inspections.

CHAIR BALLINGER: But that would be justified. I mean --

(Simultaneous speaking.)

MR. RUDLAND: -- justification for it all, but I'm just saying is that there's efforts ongoing that are looking to how to optimize these inspections. Because again, the ten year inspection interval and stuff. There was no real basis for all of that, right.

It was just a bunch of guys sitting in a room, a bunch of guys and gals sitting in a room and saying ten years is about right. Boilers fail in about ten years, you know, so a ten-year inspection is good.

CHAIR BALLINGER: So now we have a new bunch of guys and gals sitting in a room saying --

MR. RUDLAND: I don't know -- they're using a little bit more sophisticated computers, but --

CHAIR BALLINGER: Okay, unless there's more discussion.

MEMBER PETTI: So the only thing -- yeah, this is Dave -- on my list was this comment from one of our members about analysis. That somehow in guidance, there should be a focus on what the analysis be for beyond the TBS should focus on. Like defense-in-depth and containment analysis.

I just ask the member who wrote that, expand on my cryptic notes on that.

Bob, Bob. Bob.

MEMBER MARTIN: There are two aspects of that, I think. One is the containment analysis, which I did mention. The other one I think belongs more under FFRD, which is the role of the best estimate analysis in --

MEMBER PETTI: That's coming.

(Simultaneous speaking.)

MEMBER MARTIN: -- in FFRD is precluded. Or if we were to, yeah, include that we were favoring an approach that precludes FFRD as opposed to, you know allow, again, modeling. But then the fidelity of the modeling becomes more important. I think I will defer that part of the --

MEMBER PETTI: Yes.

MEMBER MARTIN: -- of that comment to the next topic.

MEMBER PETTI: That's on my list for FFRD. It was Bob who had this comment, so.

MEMBER MARTIN: Right, and some of it was just kind of teeing off some of the comments Tom had last time. I mean, the top one seemed to be the ambiguity associated with the definition of best estimate when you're in this space.

MEMBER PETTI: We'll talk about that.

MEMBER MARTIN: Right, so I didn't know when we were going to, you know, work that into, but yeah, that kind of opens up the whole conversation about what is in analysis. So I don't know if it goes here in the discussion, I don't know how we're organizing it.

MEMBER PETTI: I put it into FFRD, so.

MEMBER MARTIN: You put it into FFRD, okay.

MEMBER PETTI: Yeah, yeah, so we can wait.

Okay, then that at least -- the other comment I have is that members who made comments in the first round should go back and decide if they still want the comment to stand, or based on this discussion they want to, you know, rework their comment, or they want to, you know, they're satisfied and they don't want it as a comment.

Because we're going to come up with a, sort of a boiled-down list of, as I view the letter, you know, we're going to just have things that the staff should consider as they're also obtaining public comment.

CHAIR BALLINGER: Okay, more comments? We're scheduled for lunch at noon, and if this were an academic faculty meeting, we would be forced to discuss until noon. But we're not. So in the next presentation is with the industry and EPRI.

And so I would propose that we stick to that schedule and recess until one o'clock, at which time the industry and staff presentation will happen. So unless there are other comments that we need to consider --

MEMBER PETTI: Could we just -- could we have Weidong make -- email to the members my binning so that they can see how we're going to keep it focused this afternoon?

CHAIR BALLINGER: I think we have it.

MEMBER PETTI: Okay, okay.

CHAIR BALLINGER: I think we have it. For the public, though, this thing that we're talking about is in the ADAMS, but it's not public yet but it will be. So I don't know when that's going to happen. But that color-coded table, if you want to call it that, is going to be available.

MEMBER PETTI: Okay.

CHAIR BALLINGER: Okay, once again, let's recess until one p.m.

(Whereupon, the above-entitled matter went off the record at 11:31 a.m. and resumed at 12:59 p.m.)

CHAIR BALLINGER: We're back in session and we're going to hear from the industry/EPRI folks, I should say gang, but anyway, the floor is yours.

MR. CSONTOS: Okay, thank you.

CHAIR BALLINGER: Well, I don't know who's going to speak first so.

MR. CSONTOS: Yes, I'll go ahead and speak first and then we have basically a chorus here. We had heard the interest, and also hearing about the industry plans and strategic plans, so we have four utilities that will provide an update on their plans to give you a microcosm of what's going around the industry.

I'll give you one slide that talks about it generically, but you're going to hear from four different utilities specifically. Both their interests and what they're planning to do but also the concerns that they have. Okay?

We have also have the BWR and PWR Owners Group represented here as well and EPRI represented. EPRI will be presenting on the ALS after this discussion, but we also have Brian Mount from the BWR

Owners Group and Baris Sarikaya online, who is also a representative of the BRW Owners Group and, Brian, you're on the PWR's group, sorry.

We also have two members who got COVID last week and so that's why they're not able to be here in person, but they'll be online to answer any questions.

VICE CHAIR HALNON: Your chorus needs to sing their name before they start.

MR. CSONTOS: Sure. Al Csontos, NEI director, fuel.

CHAIR BALLINGER: Remember, we have until 2:15 so you don't have to speak like normal radio announcer that speaks at 500, 1,200 watt or something.

MR. CSONTOS: Okay. Let me go to the next slide. What are our key messages? LARs are coming. They're coming for both advanced fuels and that's what the latest ADVANCE Act changes. Both advanced fields are, quote, advanced reactors fuels, but it is also talking about ATF requirements for higher burnup. So, now they're tied together. There's a section on the ADVANCE Act for fuels and so what you're seeing here is plants are already looking to implement some of the ATF dopants as early as 2026 as deployments and going on after that to '27,'28 and we have a graphic. It's more just pictorial but it shows that after 2026, we're starting to see basically a ramp-up of these LARs coming in for advanced fuels.

Now, I'll go ahead and talk about uprights and the connection between that and the advanced fuels and how it connects the IE -- the advanced notice for rulemaking, but the key here that we want to make sure that we express to you all is that the rule and schedule is really important to those strategic plans. You'll get more of that from the utility members in a second here.

We did appreciate that you all had that meeting in December. We did present after everything was over on the reg guide 1.183 and we did see a lot of positive and appropriate improvements in the rules. There are still some major concerns and we'll go into them today. We did have this letter and we wanted to make sure that that letter is shared with the ACRS members. Their ML was down there.

This is a letter that we sent to them back in March 2023 as a follow up to the Commission ATF briefing that we had with the Commission and there were some questions asked about 50.46c. We responded and provided some feedback and how we thought the 50.46a and 50.46c could be modernized and incorporated to the increase in regulatory rule making. Those were some comments we made way back then and a lot of them, I think, are apropos to what we heard today and also back in December. We wanted just to highlight that we had that letter.

The second to last bullet here just highlights to meet the schedule, we really would like to have this public comment period, this rule to go out for public comment, so that we can start engaging with the staff, maybe even providing white papers and whatnot on a variety of these topics that we're hearing about today. Similar to reg guide 1.183, where we had multiple workshops after rev one came out, we had those engagements.

What it did, was really it highlighted -- it did a lot that before the ADVANCE Act came out, we did a lot of those workshops before the ADVANCE Act came out, but what it did was really create those efficiencies and talk about implementation with the staff to get a better reg guide 1.183 in rev two. Next.

What are the benefits that we see? One, it enables the improved safety with less generated waste and Fred will talk about that with respect to the 24-month cycles. It allows the increased enrichments to LEU+ to 10 percent enrichment. The UF6 packet that's a big deal right there when Jason Piotter at the December meeting talked about what they were doing there with the UF6 packet being approved up to 10 percent. That saves a significant amount of effort and time in getting the enriched products to the market.

The improved risk informed control rule, those design criteria, those that were changed, those were very useful and also very risk-informed. Those were really a really good by the staff. Reg guide 1.183 also was a fantastic job by the staff. More realistic modeling and also considerations of all the things that we talked about in those workshops and those workshops did a great deal to develop more predictable, durable, and also usable guidance by the industry.

We talked about it this morning a little bit, this openness to large break LOCAs beyond design basis. I know that we may be disagreeing over some of the particulars and the details, but the NRC staff's openness to consider large break LOCA as a beyond design basis event has the potential for both existing and new reactors for major improvements.

Lastly, the work that the staff did on NUREG-2266, think of the showing of the GEIS throughout there were okay to be used and not having to be redone other than a weight percent enrichment and 80 gigawatt-days burn up was a big deal. That really saved us a lot of time. We were very concerned about that.

Nevertheless, we're here to talk about some of the areas that we see that remain deterministic, prescriptive, and really not risk-informed with additional burdens and you're going to hear this from the utility members about the high uncertainty to implementation.

I don't want to belabor this. We've briefed you on this in the past, but basically the advanced fuels are complementary to uprates in some cases and you're going to hear that from a couple of the utilities today about how they're trying to employ both. We believe that this has got an improved safety basis from the current fuel and also we believe that we're moving forward and the LARs are coming. They're already started. We have plans to deploy and that's where we're moving forward with this and we're hoping to get the IE rulemaking done by 2027 to support those strategic aspirations of the industry.

At a high level, 70 percent of the plants, and it's probably more than that now, more and more plants are getting involved. This is the latest as of last fall, 70 percent of the plans out there have an interest in doing power uprates, up to 3 gigawatt electric. That has gone from 2 a year ago, to 2-1/2 half a year ago, to 3 now. If I did it again this summer, I'd probably go up a little more. Nearly half of the fleet are also looking into ATF/LEU+ higher burn up and the 50.46a risk-informed LOCA type of analysis approach.

With that, I wanted to turn to our utility colleagues for their perspectives.

MR. STAVELY: Jim Stavely, nuclear fuels director, PSEG. PSEG is concerned about the 50.46a rule --

CHAIR BALLINGER: Can you speak a little closer to the --

MR. STAVELY: Is that better?

CHAIR BALLINGER: Hopefully.

MR. STAVELY: Okay. PSEG is concerned that the draft 50.46a operations --

(Simultaneous speaking.)

MEMBER KIRCHNER: Ron, this is Walt. Could we ask the speakers to identify themselves and use the microphone? Get the microphones closer. Thanks.

CHAIR BALLINGER: Message transmitted.

MR. STAVELY: Okay, this is really close. Is that much better?

CHAIR BALLINGER: Yes.

MR. STAVELY: Okay, Jim Stavely, Nuclear Fuels Director, PSEG. Good afternoon.

PSEG is concerned that the draft 50.46 rule and supporting regulatory guidance as currently written may not support implementation of increased enrichment and higher burn ups required to achieve 24-month fuel cycles. It may also impact the implementation of advanced fuel designs. Portions of proposed requirements and processes are not risk-informed, do not sufficiently leverage existing risk-informed processes and would create a burden reducing and perhaps eliminating the basis for implementing the voluntary rule.

Some aspects originally defined require significant analysis, do not provide sufficient flexibility and alternative approaches and create significant regulatory uncertainty. As an example of alternate approaches, the draft focuses on alternate 2, as we heard this morning and back in December, utilizing transition break size without providing guidance for potential implementation of Alternatives 4 and 5. As drafted, this rule does not effectively support BWRs. Modified attached Alternative 4 supports both BWRs and PWRs, EPRI ALS, we'll talk about again a little bit later, already under review by the staff supports modified Alternative 5 for PWRs.

Examples of burdens include the requirements for additional inspections as we discussed this morning with the associated increase in dose, as well as the creation of a new risk assessment process to evaluate plant changes for potential 50.46a impact. We recognize that the rulemaking schedule does not permit resolution of all these issues, but critical changes are required to improve the potential for implementation.

Utilities are actively planning and we're making commitments that depend upon meeting the rulemaking schedule with a rule and supporting guidance that are implementable. Without changes to the rule and the supporting guidance, these plans will likely be reassessed. The changes should be made prior to the comment period if possible, as we discussed the potential for the workshops, to ensure that the rulemaking is completed on schedule. The upcoming presentation will discuss the industry's perspective and some of these required changes.

With respect to the path forward and Al did mention it and it was mentioned this morning as well by staff, is we recommend an approach similar to revision 2 to reg guide 1.183. I have been the industry sponsor for that revision to the reg guide and this approach worked very well. It encouraged active and constructive interaction with the result being more effective, implementable, risk-informed regulatory guidance while maintaining the focus on the health and safety of the public.

In closing, we have been making plans and decisions based on the assumption that the IE rulemaking process would result in implementable regulatory structure and maintain the attractiveness of implementing 24-month fuel cycles and advanced fuel designs. Based on the current drafts, we have some doubts whether this assumption is still valid. Thank you.

MR. CSONTOS: Tara for Duke.

MS. MATHENY: Good afternoon, can you hear me okay? All right. Good afternoon, I'm Tara Matheny. I work with Duke Energy and I am the fuel cycle extension project manager.

Duke Energy is currently making investments in its nuclear fleet to pursue fuel cycle extensions for five units and to add approximately 250 megawatts of capacity through power uprates for the next six years. We are concerned with the draft language, the timing of the final rule and the uncertainty of the implementation requirements.

Duke Energy is planning to have the first 24-month core online in the spring of 2029. These cycle extensions and power uprates are a foundational part of Duke Energy's plan to reliably meet current and future customers' energy needs and achieve the company's carbon reduction goals. This plan has been submitted and approved by the North and South Carolina Public Utilities Commissions.

We look forward to the presentation of the challenges that the industry has identified with the draft rule language that if not adequately addressed by the staff would result in our need to reconsider our strategy to meet these commitments. Thank you.

MR. CSONTOS: Thank you, Tara. Jonathan for Southern.

MR. CHAVERS: Good afternoon, this is Jonathan Chavers, director nuclear fuel analysis at Southern Nuclear, speaking.

As Southern Nuclear has demonstrated with our licensing engagements and our numerous lead test assembly programs to date, our fleet has intentions to leverage ATF technologies, including increased enrichment and burn up extensions. Based on our experiences to date and scoping for future reload applications, Southern believes this rulemaking is timely and the scope is aligned with our means. Across stakeholders in commercial nuclear fuel, engineering work and investments are underway which aligns our planning schedules with the assumption that the increased enrichment rulemaking and supporting regulatory guidance is complete in accordance with the Commission-directed schedules.

The substantial efforts by the staff and industry cannot be understated in the progress made to date. It is important that this rulemaking is structured with the durability for decades to come in the future. That being said, as was discussed this morning, we fully anticipate that some of the regulatory guidance will be a living product that will evolve as our understanding grows in the expanded operating domains of the future.

The codified language should exhibit adequate durability to facilitate many of the future states possible as discussed this morning. Our most substantial concerns about the viability of the proposed regulatory infrastructure and proposed implementation burdens, they do not appear to have a strong technical basis or align with maintaining or increasing the existing safety performance.

Industry experts will give you much more detail than I will right now in the subsequent presentations, but in general there are three broad areas of note: Implementation burdens. An example is the increased inspection frequencies, expectations for established programs potentially resulting in increased occupational dose for our workers. There is missed opportunity for more generic assessments. Some of the proposed plant-specific analyses supporting activities that could be generically addressed by industry or generically addressed together, increase the burden for all stakeholders without a demonstrated safety benefit and the discussions around risk-informed applications. The potential for more restrictive risk-informed change framework that's currently in use does not seem to be prudent or justified.

Southern has demonstrated that licensing of enrichments above 5 weight percent uranium-235 and commercial nuclear power reactors is possible. We've done that for lead test assemblies within the existing regulatory infrastructure. However, based on our experience and future scoping, this approach that we took for these lead test assemblies is not an efficient use of resources for NRC or industry to implement reloads or enable broad industry adoption of higher enrichment technology prior to the completion of the increased enrichment rulemaking.

That being said, utilities will make every effort to make our commitments to our stakeholders. In a final rule delay situation, it could result in a large number of exemptions or a disparate licensing submittals, which could be mitigated through timely issuance of this rulemaking and associated regulatory guidance. That being said, this is a clear example of this rulemaking being implemented on the timelines proposed and associated guidance to correspond with it per the Commission-directed timelines would embrace the mindset as described in the ADVANCE Act. Thank you.

MR. CSONTOS: Thank you, Jonathan. Baris for Constellation.

MR. SARIKAYA: Good afternoon, my name is Brais Sarikaya, principal engineer, Constellation. I'm also the BRW Owners Group safety analysis subcommittee chair.

The draft rule has great potential for the industry, especially for those utilities considering power uprates, cycle extensions, and/or high burnup increased enrichment implementation. It also provides a potential to improve operating units for some of those LOCA-limited stations.

Maybe more importantly, an opportunity to focus on the right area to improve plant safety where it matters the most. We are also encouraged with the discussion around combined license applications. Just like the previous utility members discussed earlier, Constellation is also considering power uprates, MUR, and/or cycle extension potentials within the fleet. We appreciate the level of flexibility available to us in the draft guide; however, we are equally concerned about the uncertainty around the implementation requirements for some of those flexibility options. For example, we do support ALS for PWRs, that's a great path forward; however, lack of a similar solution path for BWRs concerns us.

Indeed as discussed earlier, lack of BWR considerations is a common theme for a number of areas. For example, the requirements to identify transition break size or demonstrate applicability of NUREG-1829 and -1903 to the individual stations are challenging. We are concerned about the uncertainty in this area, especially for those plans as we heard this morning that do not currently have leak before break approach.

We believe Alternative 2 has great potential, as I mentioned at the beginning of my discussion, for large break limited PWRs and BWRs, but it does not consider the fact that we have small break limited LWRs in our fleet. Therefore, we believe the modified Alternative 4 as proposed by NEI and PWR Owners Group should be considered as part of this discussion. If you look at even the basis document, this option is technology-neutral and could benefit both BWRs and PWRs.

Overall, we are hopeful with this efforts, but concerned about the unpredictability in implementation which, as discussed several times earlier, significantly increases uncertainty and risk for major projects, such as power uprates. We are looking forward to the detailed discussion later today and further collaboration in future workshops. Thank you.

MR. CSONTOS: Thank you, Baris. What we're going to do next, we're going to have Victoria talk about the LOCA risk significance.

MS. ANDERSON: Thanks, Al. Victoria

Anderson, a technical advisor for engineering and risk at NEI. Risk-informed regulation calls for us to examine the plant and focus on what's most important to plant safety, which is what we've used risk-informed regulation for, and if you look at the graph on the top right there, that's a graph of the average industry CDF starting in 1992 and going through, I think it's 2020.

In that time, we've decreased CDF by a factor of 20 and that's in large part due to the risk-informed programs that are highlighted above. The graph comes from NEI-20-04 if you're interested in more details and what goes into this. The units on the left are just the baseline average CDF of 1992, so it's just showing a comparative average CDF. Keeping that lens for our regulatory oversight and operational activities is vital to continuing that kind of progress and continuing to drive down the CDF and improve plant operations.

For this specific activity, we're interested in the context of LOCA contributions to total plant risk. We took a look at a NUREG on initiating events to look at the relative contribution and found that the relative contribution of LOCA events is under one percent of the total core damage frequency and we have confirmed that this comports with currently licensee PRA models. So, you're looking at less than one percent.

Also, consider the that NUREG is from a time that's over towards the left side of that graph so the actual CDF impact is even lower than would have been suggested by that NUREG. Adding even more into that insight on the relative contribution of LOCA events to total plant risk is that our PRA models are more detailed and higher quality than they were 20 to 30 years ago and on that left side of the graph, so we have even more confidence in our results and more confidence in our PRA models than we did when this portion of the rule was initially developed.

You can also see this continued improvement in the increased capacity factor which is on the bottom right. We've gone from the low-60s to the mid-90s in the past 45 years and overall plant reliability, as you can see from that, has improved substantially no doubt with much credit due to risk-informed regulation.

When you add of this together, it shows that it is reasonable to treat these as beyond design basis events and it is, in fact, in the best interest of overall plant safety to do based on what the information we have from the plant PRAs tells us. That's to say we can't ignore it, but it may not be where we need to devote a large amount of our focus in maintaining CDF operation of the plants and as part of a risk-informed regulatory frame work, which has enabled safety and operational improvements fleet-wide for several decades, we need to be mindful of where we devote our attention.

VICE CHAIR HALNON: Victoria, where's the footnote, any time you have a number there you get a footnote. Is that a --

MS. ANDERSON: I have a foot -- oh, no that's per year inverse year. It's not a footnote, it's a minus one.

VICE CHAIR HALNON: It's a minus one? Oh, okay.

MS. ANDERSON: Yes.

CHAIR BALLINGER: A very faint minus one.

MS. ANDERSON: Yes, sir. Sorry. I think we needed to -- yeah, it looks like a big R with a one, but it's a minus one.

VICE CHAIR HALNON: Okay, got it.

MS. ANDERSON: We need a darker font.

MR. CSONTOS: Okay, so next please understand that the feedback we're going to give you is early. We want to get this into the public comment period so that we can provide more details and we were even thinking about writing a letter with more details in it. This is really a review of what we saw back in December. It's about a month and really we had last week to see 14.28, so what you're going to see here is very early. With that, I'm going to turn it over to Brian.

MR. MOUNT: Good afternoon, my name is Brian Mount. I'm a consulting engineer at Dominion Energy. I'm also the analysis committee chair for the Pressurized Water Reactor Owners Group.

You heard mention earlier that the public workshops on the reg guide 1.183 revision led to a lot of benefits. Those benefits are going to help with our implementation as well of that reg guide and the NRC review of our implementation because we're following the guidance, we're not having to take deviations from it. We are looking forward to additional public workshops on the following areas.

For the first slide, the 2010 draft 50.46a had a substantial implementation burden and we feel that a lot of that burden still remains in new draft rule package. Now granted, this was also from what we read in the draft rule language and in the DG. This was before we had seen the NRC's presentations. We feel that one of the areas that there could be some implementation burden relaxation is in the risk-informed evaluation process.

We've mentioned that there have been several regulatory interactions in the risk arena that could benefit from the efficiencies and the learnings we have gained such as risk-informed tech spec completion times. The draft rule does still require the low power and shutdown PRA models, which the industry had addressed with the NRC passed 2010 alpha rule and that was with the interactions on the NUMARC 91-06.

Similarly, the 50.46a(h), the risk-informed process paragraphs in the regulation duplicate a lot of the information that is in reg guide 1.200 and 1.74. This duplication does not appear to be necessary from the industry's perspective because the information has been in the reg guide and we've been following it. Those reg guides, as they continue to evolve and be updated, it could create a difference between what's in the LOCA rule for defense-in-depth and risk-informed regulation compared to what would be the reg guide's which are going to be updated to keep improving with our state of knowledge. Next slide.

Another item is that the NRC robust PRA

management program that we submitted as part of our license renewals, we do not feel that those were getting significant recognition in the draft guide language. Following the NRC's presentation and hearing their perspectives on it, we'll go back and relook at the language. Again, this was informed out of what we read in the rule language and read in the draft guide and was not informed with our interactions or based on interactions from the NRC staff.

DG-1428 does acknowledge that the industry did significant seismic risk assessment following the Fukushima-Daiichi event. That was highlighted in the NEI letter. Victoria, do you have the specific item?

MS. ANDERSON: Yes, so as we've noted that rule language was developed back in 2010 which was before any of that work was done, so it would be logical to update that language and that approach to reflect the work that's done so that we don't need to either duplicate work or potentially conflict with work that has already been done and already been accepted by the NRC.

MR. MOUNT: As far as the additional in-service inspection frequency requirements, the way the industry had read what was in the rule language in the draft guide previously was that this would be in addition to the sampling of 10 percent of the welds in pipes larger than the transition break size was going to be, in addition and above the 10 percent of the sampling we currently do as our ISI programs. We had considered that to be not consistent with risk-informed regulations with the clarification that staff provided that that was meant to be substituted into part of your risk-informed inspection programs, we will be reconsidering that. Regardless, the welds that we've selected this time are based off of our plant-specific risk profiles. Areas where we already know have the high stress so to replace the welds that we're currently inspecting with other welds that are above the transition break size does not seem to be consistent with how we want to implement a risk-informed regulation.

CHAIR BALLINGER: This is Ron Ballinger. I thought this morning we had a discussion about this that the difference between 10 percent and 10 percent might be overlapped but not separated.

MR. CSONTOS: Yes.

CHAIR BALLINGER: So, it's not like all of a sudden you've got to find 10 percent more welds to --

(Simultaneous speaking.)

MR. CSONTOS: That's where we were -- we didn't have the indication back then. We only had this last Tuesday, I believe, so we only read what we read and we thought that's what was meant with the official --

CHAIR BALLINGER: Okay, so that's been cleared up as far as I'm concerned.

MR. CSONTOS: That's what Brian was talking about. The other part to this was that the hard wiring, that 10 percent number, into -- codifying it into the rule, I'm not sure if that's a wise thing either. That's something where you have a learning aging management program where you assess what you get and then you change as a function, that's all that aging management programs do.

But requiring 10 percent, it's kind of going outside of what ASME code is doing as well as what a learning aging management program would do, it's to hard wire it into the rule language. There may be other ways to address it, but just hard wiring it in, it just seems like it's a little too far.

MR. MOUNT: And similarly, as we had read through the options in the draft guide, we had not seen as much credit as we would have liked to have seen for the leak before break program. That will be another item that we, as the industry, will have to go back and look through again and hope as we go through workshops with the NRC staff, we can make sure that our concerns are heard and make sure we have the language clean and clear for our constituents.

I think a number of the items on this can be cleaned up through the workshops with the NRC to make sure that what we're reading and what they intended that we get that from what the words are in there.

MR. CSONTOS: Right, and I'm crediting, you know, we have susceptible welds. We have non-susceptible welds. We have unknown unknowns is what, I think, the term novel degradation means and in that way, you might be able to sample other welds that are of similar types that also have the same potential degradation mechanisms in the future. You don't have to go with just the largest lines out there beyond VBS to get to understanding whether you have a degradation mechanism.

On top of that, there are a lot of things in there that could be helpful to have a workshop to discuss what this looks like and what's palatable in terms of making sure we have an eye to dose and -- dose to workers, and what is an optimized approach to look at what the NRC is trying to address in this inspection.

VICE CHAIR HALNON: Brian, this is Greg. Your first bullet up there, NRC clearly looked at aging management. We used aging management that's not credited, but to use the adjective robust, which is a very bad thing to do because now I'm going to ask you what above and beyond guidance in your aging management programs deserves more credit in the NRC's giving it? Typically, every license renewal aging management program we see come in leads to guidance. Are you saying that the robustness is beyond the guidance? Are you going well beyond it? That's what it implies.

MR. MOUNT: So --

VICE CHAIR HALNON: Or do you want to take that word back?

MR. MOUNT: That's probably a better way to do that would be probably to look to take that word back out of this slide, but if it's already put in. Al, was there anything particular that we were going with, with the robust word there?

MR. CSONTOS: I think that it was just meant to highlight that there are --

VICE CHAIR HALNON: You might use colors instead of adjectives --

MR. CSONTOS: Yeah.

VICE CHAIR HALNON: That don't necessarily -- okay, I just wanted to make sure because the NRC does talk about the first block in their program process for 1829 was aging management programs.

MR. CSONTOS: So, that's where it gets that, you see it on the flow charts and what does constitute acceptance in those blocks. And when you have that basically analytical gauntlet there, I heard someone talk about the analysis paralysis at the last -- in December's meeting, and those flow charts what constitutes -- is it just a check box? We don't know and that's the thing here. We saw the presentation this morning. We haven't had a time to discuss what are the expectations from the staff. Are these check boxes that do you have an aging management plan, that's easier or is it how robust is your aging management plan? What do those boxes constitute? In that way, there are differences into how we would respond based upon what the expectations are from staff.

VICE CHAIR HALNON: That's where the workshops will come out --

MR. CSONTOS: Correct.

VICE CHAIR HALNON: -- for a brief which I heard them say they want to have. While I've got the floor down over to Walt because he has a question for the industry folks, is the schedule inflexibility that you all are kind of alluding to a combination of business plan an added schedule? Is that -- basically you have a five-year or 10-year plan, it's pegging things on different added schedules and schedules obviously can't change on the outages all that much. Is that basically it? Each one of you said something about schedule and plans and stuff like that.

MR. STAVELY: Yes, Jim Stavely with PSEG and the answer is yes. It includes the sequencing of the activities for the outage schedule, because that -- it means we have to coordinate the multiple refueling outages and staff and all the resources.

VICE CHAIR HALNON: And typically you design your cores about, what, a year in advance to get the orders in?

MR. STAVELY: We do design them in advance. We also have to provide in advance all of the uranium conversion enrichment requirements for that, also in advance of that is (audio interference) markets, so it all influences -- it's a very integrated schedule.

VICE CHAIR HALNON: Okay. I wanted to get that on the record because I knew that there was a lot that goes into these dates well before the date that you're talking about.

MR. CSONTOS: And let me just add one thing. Tara, you might add to this if you want. What we're talking about also is when you do a fleet-wide implementation of this, it's not just the event for that first plant, it's every other plant and if you miss that first one, you then cascade down 18-, 36-month delays. If we miss this time frame, we could be with that fifth plant, for example, that Tara was talking about, you could be out, way out there. It could change the entire plan that you have with the PACs.

VICE CHAIR HALNON: And you're spending your resources on things that you shouldn't be --

MR. CSONTOS: Exactly.

VICE CHAIR HALNON: Because it's going to be down, okay. Walt, I'm done if you wanted to go.

MEMBER KIRCHNER: Yeah, thanks, Greg. Just looking at these both, they kind of all make sense to me and it would be interesting to hear how industry would suggest improvements to 14.28.

I just wanted to ask on the last bullet, how many plants have approved LBB programs? Just a rough order number.

MR. CSONTOS: I believe all the PWRs. I'm looking at Dave Rudland. He knows best.

MEMBER KIRCHNER: That's what I thought.

MR. CSONTOS: Except for one PWR, I believe.

MR. RUDLAND: At least one PWR.

MR. CSONTOS: Yes, one PWR that hasn't gotten LBB, but no BWRs and to the point this morning, I think there was a question about mitigation, all the BWRs do hydrogen water chemistry, noble metal chemistry, that's a mitigation. In that way, I think that we could probably go with getting LBB hopefully approved for BWRs with two mitigations and many of them have MSIVs and overlays on the other susceptible lines. So, maybe there's a way there, but that's something that as, I can't remember who brought it up, oh, Jim, I think you brought up option 4, Alternative 4, as another way for the BWRs.

MEMBER KIRCHNER: Yeah, so on the first sub-bullet here, do you feel that the industry has addressed this generically after Fukushima or -- I'm just trying to see how you would envision modifying 14.28.

MR. CSONTOS: We have a -- the parentheses has the -- I gave an ML earlier in the presentation, the first page, first slide. We had a letter that we sent in and we had a full paragraph and a half basically that we can provide to you on what the recommendation was.

MEMBER KIRCHNER: Great.

MR. CSONTOS: And so, you know --

CHAIR BALLINGER: I think --

(Simultaneous speaking.)

MEMBER KIRCHNER: Okay. Weidong, could we get this letter? Could the members get this letter that NEI is referring to?

MR. WANG: Okay.

MR. CSONTOS: Yeah, they're actually in the summary slides. I have two letters. The first letter was what we did back in March of 2023 which is this attachment. This NEI 2023 Attachment 1. Item two is the bullet that has that recommendation. Then there's a second letter that we sent in for the reg guide basis. The BWR Owners Group, PWRs Group, the fuel vendors and the utilities agreed on, it's an NEI letter and this is where we suggested option 5 and option 4; modified 5, modified 4 depending upon what 4 did. Four could help us with the BWRs fairly quickly we think.

Option 2 at the time was not considered because it was this longer term concept and then the staff has done a lot of work in a short period of time to try to get 2 brought in now and I think that that's where we getting some of these. There are areas that I think we can work on to get a better implementation, but longer term there's that longer term getting a large reg on a design basis like you were talking about this morning. That's what we wrote in the letter.

MEMBER KIRCHNER: And then on the second sub-bullet, you have specific suggestions on targeting the inspections to perhaps address the kind of vulnerabilities that the staff was concerned with in going to TBS.

MR. CSONTOS: We had a dialogue this morning while we were listening to the presentations going back and trying to decide how to go about looking into that exact question. Like, how do we go about optimizing this for minimizing dose but getting what NRC needs, if they feel like they need it for this activity. But it's going to be something that we have to do in the future.

MEMBER KIRCHNER: Yeah, well to your points, I mean for the staff as a challenge to craft an enduring rule that supports your needs as well as the staff's assessment on adequate safety, so any constructive things for each of these sub-bullets would, I'm sure, be welcome in the next phase when you go to the public comment period. Thank you.

CHAIR BALLINGER: I'm thinking that you're establishing an agenda for the first workshop.

MR. CSONTOS: We think that one of these, you'll see basically three different areas and I think you'll see that there are right now at least three different workshops that we see out of the concepts here, so I'll let you know.

MR. MOUNT: This is the last slide on the presentation pieces that I have. There are additional analysis requirements that are going to be needed. The new true best estimate LOCA analysis for above the transition break size, there is hinting at the need for a LOCA 50.46 dose analysis. It appears that is tied only if you would have dispersal or would be predicting rupture and dispersal for high burnup fuel above the transition break size, but that's not clear.

Both of these are new-ish analyses. The 50.46 LOCA would probably require some sort of NRC vendor interaction. That can take a couple of years to get an approved EM, or approved evaluation model, for a utility to follow and use and that would normally be again, another two year-ish process. By that time, we would have model built, analysis completed, submitted to the NRC. So, these are items that we see as kind of long schedule hauls that would challenge our implementation on the time frames mentioned earlier.

Similarly, the staff this morning did discuss that they have made changes to the rule that removes or acknowledges that the 50.36 regulation already has a process for identifying when non-safety grade equipment should be added to the tech specs, so we appreciate the NRC's updating of that when they remove the explicit requirement from the 50.46a rule and just left it with how we were going to do it under 50.34 currently.

Similarly, looking forward, the NRC staff heard during our public workshops on reg guide 1.183 we had a concern with updates to the radiological source term for equipment qualification purposes and the staff is looking at the continued use of the TID source term and we look forward to future interactions with them on that. This is an item that could be another large implementation burden that could challenge or prevent the industry from moving forward with these initiatives.

MR. CSONTOS: This one issue with EQ and the

TID source term is one that could be a show stopper for moving forward with uprates, so this is one that we highlight as being a really big topic for us to consider going forward. The staff is understanding of that.

Okay, so I'll go into flexible and durable. Again, please remember that we heard 14.28 this morning and so that may change some of the comments that we have here, but really we do have concerns that right now the 50.46a is really rigid and prescriptive defining and requiring definitions in the codifying of the language of the rule. When you codify it directly into the rule language, we don't see how it allows you to do an alternative approach. Sort of like ALS and others that if you say this is what the TBS is and explain it and you have another alternative to it, we're not sure how you get around.

I heard this morning about putting it into the guidance, but if it's in the rule we're not sure how you get out of that requirement and that's something that we need to think about in terms of discussions with the staff. Like I said, we know NRC has developed all these options and want to open up the door for these options. We appreciate that. It's just really the implementation path that you heard earlier of those options and the uncertainty associated with those options and all those boxes that I talked about and what is going to constitute acceptability by the staff.

We think that small changes in the rule language, taking some of it out and putting it into guidance would allow for more a flexible and durable path. Some of this would be that by taking out, for example, the definition of TBS out of the rule and putting it into guidance. It allows for alternatives, like the ALS. In the future, we may even try a full risk-informed metric down the road. Maybe there are other ways to evaluate break frequency with xLPR. Maybe there's an xLPR for BWRs in five to 10 years. Do we want to come back and go through exemptions or do we also want to go and make this rule flexible enough so it accommodates those other options in the future, but also not having us go back and do another rulemaking to allow those options.

VICE CHAIR HALNON: Just to make sure you're arguing with the right group of people, have you compared your desires against the language in the SRM to make sure because, you know, the staff lives and dies by the --

MR. CSONTOS: Right.

VICE CHAIR HALNON: -- specific language in the SRM. If it doesn't allow one of these things, you're arguing with them won't do any good.

MR. CSONTOS: Right. I think what the SRM was talking about was incorporating 50.46a and one of the things that happened with 50.46a back in 2015-2016 time frame was that it became too onerous for utilities to really use it to develop a risk-informed frame work to go through to get our uprates. That's kind of where we are again 10 years down the road.

VICE CHAIR HALNON: I get that. My point is that if the SRM doesn't allow them to do one of these things that you're talking about, you need to go the Commission --

MR. CSONTOS: I agree, I agree. I think that the way that I read the SRM was to incorporate 50.46a and that's essentially what we wrote in that first letter that I talked about. It talks about what we think, how you modify, alpha.

VICE CHAIR HALNON: I don't know, I didn't real the SRM so it's ingrained, but if it just says choose an option, they don't have an option of saying well, we'll give you options, allow him to go with the other options. That's what I'm trying --

MR. CSONTOS: Yes.

VICE CHAIR HALNON: -- to add some nuance here.

MR. CSONTOS: Yes, I agree, yes. I think that's all I wanted to say with these. We think it's small changes, that's all. We don't think it's major changes. I think it's more of a where you place some of these definitions.

Now, this one, what we do see on this one is that there is an Alternative 4 out there and we were supportive of it because the BWRs do need it, okay, as an option for a faster path towards implementations to get power uprates. In this case, what we see is that the DG-1425 appears to provide the guidance for implementing Alternative 4; however, the draft rule does not include the regulatory framework for this alternative means of addressing fuel dispersal by using Alternative 4.

So, it's out there and it's a more rigid and restrictive compliance limit, but we may be able to live with this if we were able to get this Alternative 4. That's the issue right now, is that there seems to be a disconnect between the guidance and not having Alternative 4 as an option.

I'll turn it over to you.

MR. BARBER: Kevin Barber from Westinghouse, a fellow engineer in the LOCA analysis area. I think a lot of this lies maybe a little bit repetitive from what we've been discussing really all morning and afternoon. The black text there is a quote from the letter that Al was mentioning, that March 2023 letter that industry supported and really the idea that again that when he just said two minutes ago related to the fact that 50.46a 10 years ago stopped because it was too onerous.

Really what we're trying to highlight on this slide are the things that we've been discussing and I think there is a recognition within this room that clearly the workshops are the better way to work with the staff and industry to figure out, for example, the seismic rate so that's something that when we listen to the staff talk and when we read this separately, there seems to be somewhat of disconnect so workshops clearly are the way to find the most viable path forward. And so the idea is that what we really want to do is just capitalize right on what the industry has found out and what we've done in the last 10 years to make sure that we clear some of these hurdles for implementation which is really kind of hand-in-hand with modernization.

Okay, the next one is industry standards and the three sub-bullets kind of step through a shared process. Some of these are owned by utilities, the inspections that go on, all the risk-informed programs that utilities have really implemented and lived by now. The second bullet is this reporting where the vendors and the utilities work together, whether errors and changes and how we can change local methodologies, how we can change for, you know, it's hot in Alabama in the summer and things like that.

What we want to account for is we have processes in place now. We've been following these processes for decades and as we look to transition part of the LOCA analysis into beyond design basis, we should be looking to also relax on these reporting requirements because, again, it's beyond design basis, that is, a non-basis accident. For example, when you're looking at inputs to a LOCA analysis and something might change like, again, it's hot in Alabama in the summer, how does that change a best estimate beyond design basis analysis and how does that change below the transition break size? Design basis accident, how do those reporting requirements?

Right now, a lot of that is very much in the rule and I feel like that is something that is something as the industry we can work together with the staff to kind of figure out a better way, an efficient way forward.

The third sub-bullet there is breakaway oxidation testing. This is something that was discussed during the December meeting. The fuel vendors, we talked about members were discussing obviously this has kind of come from Russian fuel, but within the U.S., we have these very controlled manufacturing processes. We have newer analysis methods that have kind of improved on where we are in analysis space and where our testing would be if we look back to the draft reg guides that were most recently issued in 2016.

(Simultaneous speaking.)

VICE CHAIR HALNON: Go ahead, Kevin, you weren't going by a script anyway.

MR. BARBER: No. So we're kind of back to modernization right and I think this is something the industry commented back in 2016 too. We're talking about putting a facility, like for Westinghouse for example, at our Specialty Metals Plant where we have to test these ingots and go through and do with this additional testing. We have to come up with an analytical limit and frankly, we will likely set analytical limits way lower than where the testing showed and so it's an aspect that once modernized is realized what field vendors do in our country and make sure that we're being efficient and spending resources in a meaningful manner.

Then, cladding embrittlement is the last one. The draft reg guide 1263 is there and I think the important aspect for Westinghouse and GE as well, we've licensed cladding alloys since 2016. I sat in this seat when we licensed AXIOM and discuss how we're addressing research findings that were the underpinning of the 50.46c rule. We have approved topical reports now that consider these and so what we're really looking for is when we update these reg guides with the final rule package, we kind of bring in what we've done, the interactions between industry and staff so that we're not accounting for it, we're not re-doing work that we've done. Paul?

MR. CLIFFORD: Paul Clifford, contractor. I'd like to talk about regulatory stability and predictability. This slide is actually really a good example of how quickly the NRC staff is moving on this rulemaking, as this slide is only seven days old and it's already outdated.

We don't have to go through the slide, but I really appreciate the NRC going back and restoring the long-accepted definition of LOCA. Thank you. Next slide.

Okay, so stability and predictability become very important. We heard from the industry of all these licensing actions they plan on submitting. They need to understand what the expectations are when they submit. So, stability and predictability are very important. There's a regulation, 10 CFR 50.109, it governs how or when or if the NRC imposes or backfits new regulatory requirements and positions. Because this is a voluntary alternative, the backfit assessment within the rule package, really exits the backfit assessment because it is voluntary. It's not being mandated. There are some good words that are in there. The assessment states that licensees would not be required to comply with the proposed amendments and would have the option to continue their current treatment of LOCAs. Those are very important words.

The voluntary designation for the rule, it really is based upon the NRC staff's assessments and that concluded that the LOCA fuel dispersal at current burn up limits and the 50.46c research findings were not safety significant. That's the basis why they didn't then backfit the industry with these new requirements. Now, if the new requirements were designated as mandatory, the staff would have been required to complete a rigorous backfit assessment which requires consideration of risk, safety margins and even costs.

I worked at the NRC for 20 years and I was involved in rulemaking. I was involved in implementing new regulatory positions. Rarely did we go into a formal backfit assessment and the reason for that is because 50.109 allows exceptions from the backfit and those exceptions are based on adequate protection and compliance. If you meet those exception requirements you then don't have to go into a formal backfit assessment and consider risk, safety margins and costs.

Management Directive 8.4 provides the staff with guidance, really direction for implementing 50.109 and with respect to forward fit, the management directive states that backfit has not been imposed for cases where a forward fit is being considered. It is unlikely that the change could be justified to be necessary to ensure adequate protection of public health and safety. What that means is, if you don't backfit the industry based on a certain topic, you then cannot forward fit them without proper consideration of costs, risks and safety margins.

That same logic would also apply to a compliance exemption from them.

VICE CHAIR HALNON: Paul, this is Greg. I'm not sure I understand your point. Are you worried that they're going to backfit you or not going to backfit you or they're going to --

MR. CLIFFORD: My concern is we're going to be forward fit.

VICE CHAIR HALNON: Okay.

MR. CLIFFORD: But we're not going to see it coming. In other words, there's going to be an LAR that comes in place, say for a power uprate or any other licensing action, not involving high burnup, not involving an increase in enrichment and when it comes in for review, the staff is going to try to forward fit some of these issues onto that licensing action.

VICE CHAIR HALNON: Is this what you would have done when you were at the staff?

MR. CLIFFORD: I was guilty of that but in 2019, if I'm being honest. I think we're all a little guilty of that.

VICE CHAIR HALNON: Paint a C on his forehead.

MR. CLIFFORD: But in 2019, everything changed because the management directive was revised and this concept of forward fitting was really structured just similar to what backfitting is.

VICE CHAIR HALNON: It's still there, but now it's got some structure behind it.

MR. CLIFFORD: Yes. It's got much more structure --

(Simultaneous speaking.)

VICE CHAIR HALNON: This is just a concern, it's not necessarily written in the rule, the language doesn't encourage it, you're just concerned that this could happen?

MR. CLIFFORD: I'm concerned it would happen and it would really slow things down. We're going to have a lot of licensing actions. Those licensing actions are going to be on rigid schedules and if we submit something and then all of a sudden we realized that we didn't meet the expectations because something has changed then that challenges the schedule.

VICE CHAIR HALNON: Okay, fair enough.

MR. CLIFFORD: So, that's really the second to last bullet here. Based upon the guidance that's in Management Directive 8.4 and the backfit assessment that's in the rule, we wouldn't expect, we don't expect that our future LARs and vendor topical reports, which comply with the existing 50.46 would be subjected to any of the new requirements. In other words, we would continue our current treatment of LOCAs.

The last bullet is really to emphasize that we don't want our fuel vendor topical reports to be forward fit with these requirements. Sometimes, fuel vendor topical reports are a vehicle for the staff to impose new requirements on the industry and so we don't think that should be allowed.

Okay, so the purpose of this slide is really to begin the conversation on what constitutes an acceptable best estimate methodology for evaluating above the transition break size. The staff expects that using best estimate methods and more realistic assumptions that the quantity of the calculated amount of fuel dispersal would be eliminated or greatly reduced. So, there's an expectation that using best estimates is going to help solve the problem of fuel dispersal; however, obviously relaxing some of the assumptions is going to have positive impact on the calculated amount of fuel dispersal, but really it's the implementation. The details of what are the requirements of the best estimate can have a dramatic effect on the usefulness of best estimate vending.

I just wanted to highlight that beyond

design basis analyses are used to fully understand the capabilities of the plant design rather than establishing tech specs or LCOs based upon fuel performance. Beyond design basis conclusions should not be obscured by artificial biasing and so based upon the beyond design basis categorization of the above transition break size, we think that there are certain characteristics of best estimate methods which should be acceptable and, again, this is to start the discussion because if we don't have a good understanding of what will be acceptable, then that's going to lead to regulatory instability and uncertainty.

If you want to know that we've met the mark, it would be good to know what the mark is. Here are just some examples of what we think would be acceptable that you would use nominal initial conditions when running your transients. Beyond design basis events are not the basis for tech spec LCOs, those are design basis accidents, so we shouldn't be evaluating whether or not the ranges, the extremes of LCOs are acceptable. We should be using nominal and that's been practice for some other beyond design basis accidents.

The break conditions and the considerations of the envelope and considerations for the break should reflect actual physical plant characteristics and that includes the frequencies and relative frequencies of occurrence of the break, location, size, et cetera, and that the mitigation systems, the safety-related systems and the non-safety-related systems that can be credited at their full capacity. There's no single failures. The off-site power is available. Finally, the code methods should be best estimate and applied without bias.

MR. CSONTOS: Okay, so if I could just summarize here so we can move on the EPRI slides next, that we believe that the Increased Enrichment Rule with the addition of the 50.46a and c, and modified 50.46a and c, could enable more realistic operational margins for these new LEIs coming in, for new margins for going in and getting uprights and 24/1 cycles.

The IRA came out and incentivized us to go get those. The latest IRS tax guidance came out last week as well, and also further incentivized us to go forward.

So, all I can say is that there may be even more interest in IRAs after the IRS guidance change last week.

And so, with the intent of the Advance Act we're here to increase efficiency of the regulatory process here.

And so, one of the things we would like to do is make sure that we have alignment between the Commission direction in the SRMs as Member Halnon said, and that is that direction plus the intent of the Advance Act to develop this more modern risk inform.

And to really keep the point, Kevin brought it up, efficient process.

These are the two ML numbers for the NEI letters. We provide all the details in there of basically, our comments are, remain consistent from those, those two letters.

And really, this is really important for the utilities, and the implementation. And this is what we talked about in December is this holistic implementation plan.

If we can get a better understanding of that, then it reduces the risk, and it's really a risk mitigation approach for going forward with these uprates, and 24-month cycles if we get a more predictable and stable path.

And so like is said, that can be done in workshops. And I think we all got agreement that there's a real good basis to go to workshops.

And with that, I'll take questions or we can bring Fred over, or do you want to just do it there?

MEMBER PALMTAG: Yes, this is Scott Palmtag.

I just want to clarify one thing. I think you were pretty clear on it, but option 2. Lot of discussions on option 2.

From what you're saying, that's not going to help BWRs at all, right?

MR. CSONTOS: So, the way that we see, so again, this is, this is early, early. We just got the 1428 last week, okay?

They're not approved for LBB, so there's a lot of things that are not going to be in that flow chart that will hit them, all right, or they'll be able to use.

There are some things that they'll have to use but then there's also a line that was incorporated into 1428 that when we read it, looked like there was a more, a much bigger hurdle to climb.

Or much bigger mountain to climb with respect to doing all of the analytical analysis to address these issues for BWRs.

So, we think that the only way to get there in a reasonable time period right now, is alternative

4.

MEMBER PALMTAG: So if option, if we keep pursuing option 2, the NRC's, I guess, option 2 were basically ignoring 130 completely, is that right?

MR. CSONTOS: Could be. Yes, so we wrote this all in the letter, the second letter here.

MEMBER PALMTAG: I just want to clarify --

(Simultaneous speaking.)

MR. CSONTOS: Yes, so --

MEMBER PALMTAG: You've said that but it was kind of hidden, correct?

MR. CSONTOS: Yes, so I mean I could, we could pull in some GE folks here if you want to, or the BW Interest Group, but that's one of the reasons why we wrote -- oh, Baris, go ahead, Baris.

MR. SARIKAYA: Yes, can you hear me? Thanks, Al.

That's a great question, Dr. Palmtag. As Al mentioned, BWRs indeed, would benefit from, at least half the fleet would benefit from option 2.

But the path to option 2 is significantly more challenging for BWRs, and frankly, not existent today.

So, to make a business decision to go to option 2 with that much uncertainty, is we need to include that risk in our considerations.

And with that as Al mentioned, we are looking into alternatives, which is like option 4. The way that NEI proposed in the alternative option modified alternative 4, is a solution that may be achieved quite a bit faster for BWRs.

MEMBER KIRCHNER: This is Walt Kirchner.

Could you be more specific about what the major challenges for the BWR fleet --

(Simultaneous speaking.)

MR. SARIKAYA: I do not have --

MEMBER KIRCHNER: -- under option, under 2 or 4. What is the technical issue that is the problem?

MR. SARIKAYA: I do not have leak-before-break for boilers. So, how I demonstrate compliance or continue the applicability of NUREG-1829 and -1903, is challenging.

MEMBER KIRCHNER: And specifically, how?

MR. SARIKAYA: In --

(Simultaneous speaking.)

MEMBER KIRCHNER: Let's say you get an exemption from the leak-before-break provision in the guidance or the Rule, then what would you do as a surrogate for a BWR?

MR. CSONTOS: So, we have Guangjun Li, from GE here behind you, and he can answer some of those questions.

MR. LI: This is Guangjun Li, I'm the Principal Engineer with the Hitachi.

For BWR, we have probably have half is a license plant, and small break limited plant.

So, for this option 2 as we transition break side, based on the NRC's evaluation actually, it's largely over the filament line, or the RHR line.

This goes like from 13-inch to 20 inches. So that's basically if you cut this area, it's lined into the larger brick, traditionally light brick. It's greater than 1 square feet.

So basically, option 2 only have help for some of the BWRs but will not, will not be working for half of the BWRs.

So, because we are small break limited. So basically, the temperature is pretty high and the intermediate break and the large break -- small break.

So, you, the competition over there with the pressure, all of this and ADS, all of this dependent, so we did a preliminary calculations. We found that intermediate break actually, we see the preparation.

So, this is only preliminary. We haven't considered everything not yet. So, basically that's why in 2023 we had it centered.

We have modified alternate 4, so which will be working not only for BWR, actually for TWR, too.

MR. CSONTOS: And let me just, this is Al Csontos, NEI.

One of the things that's nice about the option 4, alternative 4, is that it's for the full break spectrum, not just large break LOCA, okay?

So, that's one of the reasons why we looked into it and it also is technology neutral to the Bs and Ps.

But we believe, still believe in EPRI ALS, and, you'll hear that next, is the fastest path for the Ps to get to the 24-month cycles, which is what, who is really going to be at the benefit of the 24-month cycles.

Did we answer your question?

MR. SARIKAYA: And one more thing to add to Guangjun's explanation. This is Baris Sarikaya again, Constellation.

Even for the half the fleet that benefits, that could benefit with large breaks on the BWR end, the identification of transition break size with, in the absence of leak-before-break, is significantly more challenging.

MR. CSONTOS: Walt, did we answer your question?

MEMBER KIRCHNER: Thank you.

MR. CSONTOS: Okay.

MEMBER PALMTAG: So, this Scott Palmtag again.

I'm not that familiar with option 4. In terms of schedule, is option 4 still something that we could be pursued with the schedule, or?

MR. CSONTOS: That's an interesting question. So, when we wrote our letter, the second letter here in January of this year, we were under the impression that option 2 was too far out.

In fact, when you read the Reg basis, is stated that it was something that may be done later. And 4 and all the other options were achievable now. That's the staff writing that, not us.

And so, we, the way that we wrote the letter was we believe option 4 and 5, modified option 4 and 5, could be done in the time period.

And that option 2 could be pursued at a later date, kind of like what we talked about this morning in terms of taking large frame load out of full end of the design.

But then the SRM, Commissioner of SRM came down and I believe April, for incorporation of 50.46a and c, and the staff said they could still, they could go and often do option 2, and they proposed 2.

And we were like well, that's great. That's fantastic. And so, we, from what I remember reading and that's all I know, is that it was able to be done in the time period for the rulemaking.

MEMBER PALMTAG: Okay, thank you.

MR. CSONTOS: And that's the staff's words, not.

MEMBER ROBERTS: Yes, Tom Roberts. I have a question probably for Kevin.

You went through all the analyses that are considered to be onerous. You didn't talk much about the dispersion analysis. You did mention the LOCA dose.

But is that because you expect all the analyses to show a no dispersion, or because you think the reg guide on how to model dispersions gives you enough information?

I'm just trying to get a sense of who you think the importance is of the modeling dispersion.

MR. BARBER: Yes, I think that's a good comment. I think picking up from the discussion in

December, I think this maybe has to be maybe a little bit more vendor specific, so I can give you my point of view from the Westinghouse for the most part, BWR.

And Paul touched on it, too. Like, the true best estimate, what does that mean? And, for the most part, the GEI, the best estimate plus uncertainty method for large break, Framatome has the best plus uncertainty method for large break, and as did we.

And so, the question of what is it, the 55th percentile, is it the nominal models and how does that all come out.

And what I can say a couple things. We're actively working on figuring out like what exactly we think it might be, right?

So from our experience, we know there's certain plant classes, certain plant design features, that are going to push the LOCA analysis results higher and obviously push it, push it to that threshold, or that rupture criteria.

So, we're looking at that now and that's certainly something that we want to work back and forth with the staff.

I think it's premature to bring it up in this forum of what exactly we, the percentage of what we think plants would be able to make it and not make it.

Certainly, there are some plants right now that we don't think they'll have any issue making it.

And then back to regulatory certainty aspect on the 1434, the draft REG Guide 1344 -- 1434.

I think due to the regulatory uncertainty, it would be our goal to demonstrate a rupture. I think that the draft REG Guide in its certain state, in its current state, would add a lot of risk.

Talking to a number of utility folks at the, obviously we need to prep for these slides. There's a pretty clear indication that the utility would want to take a risk adverse stance of that. Not want to go down that path, given there's a lot of uncertainty.

And in my personal opinion, I also feel that trying to analyze dispersed fuel even though as Mr. Corson said from the staff in December, you might be able to kind of do a high-level conservative count.

I think the whole devil in the details type stance there would certainly come to bear, so I think we would do what we could to avoid that.

MEMBER ROBERTS: And the devil in the details mean potential for analytical paralysis?

MR. BARBER: Right, exactly.

MEMBER ROBERTS: Okay.

MR. BARBER: Yes, perception that we think this is okay approach to demonstrate again, core coolability I think is what that all comes down to in the definition.

Kind of in the 50.46 context of certain vendors might have different approaches for that, but and what we think and what the staff thinks is acceptable, could certainly not align.

And so, there's a lot of uncertainty there.

CHAIR BALLINGER: So you're saying no dispersal, that's the best path forward?

MR. BARBER: In the near term, and that's my personal opinion, yes.

CHAIR BALLINGER: Okay, we have succeeded in getting ourselves a bit behind but actually, we're not. Because we discussed item 3 on TBS earlier this morning.

So, we have time, a little bit of leeway. So, you have aced out equity except for now we have time for equity.

MR. CSONTOS: Okay, great. All right, let's go ahead and swap out.

(Pause.)

MR. SMITH: Good afternoon, I'm Fred Smith, the Senior Technical Executive with EPRI Fuel

Reliability Program, and Project Manager for the ALS Program.

Kurshad, you want to introduce yourself?

MR. MUFTUOGLU: My name is Kurshad Muftuoglu. I'm a Technical Executive at Fuel Reliability Program at EPRI. And working with Fred Smith on ALS.

MR. SMITH: So, in June we came and spent a whole day talking about ALS and some time before that, we joined NRC. EPRI interaction spent several hours talking about it.

So, I don't intend to try to condense 8 hours of material into 15 minutes.

So, I want to talk about status where we are, and then talk about a couple of points that are hopefully of interest to you, particularly considering the discussion that you all had this morning.

So, the ALS purpose is to develop a technical basis for dealing with FFRD, primarily for TWRs generated in LOCA.

The traditional approach would involve experimentation, particularly to evaluate dispersal effects.

And we are attempting to do that as a backup to this, but years away to try to measure the fragmentation velocity in the fluid for size of fragments, and mobility of fragments.

That kind of empirical approach is very time consuming, and does not really align with the industry's schedule.

So, we developed ALS to be a more timely approach. And the basic approach divides the break spectrum into two pieces, similar to the transition break size but you don't use transition break size.

So, for the main coolant loops, we use LBB credit to justify the probability of risk of disbursal using significant.

And for the small intermediate breaks, we use updated deterministic LOCA analysis that include effects high burnup and clad burst -- clad ballooning, to analyze dispersal and demonstrate that no clad rupture and no disbursal occurs.

So, next slide, please.

So, this is just mostly for reference. This is the ALS submittal. We submitted it in April of last year, and here are all the reports for your reference.

It was accepted for review in June, and we also, the NRC was generous enough to grant us a fee waiver in August, and so it's undergoing review as we speak.

Next slide, please.

So, this is the NRC's review schedule, and without going into a lot of detail, you'll notice that the first area they're focusing on is LOCA.

And we have already begun audit works, work with them. We have two meetings next week to talk about initial discussions, then we'll focus more, shift the focus to the fracture mechanics, and then finally to the leak-before-break justification.

Next slide, please. So, this is a little bit of overview repeating what I said in the beginning. So, but it bears repeating here.

So, for the main coolant loop piping, we would credit leak-before-break. That credit is informed by the probabilistic fracture mechanics results. That results demonstrates that the timeframe between detectable leakage and a rupture, LOCA rupture event, is at least 19 months.

And so, the time for operators to execute their technical specifications, identify the leakage, respond as required to shut down the plant, and then subsequently investigate and fix the leak, is much less than the time that we would expect a rupture to occur.

Now, that 19 months assumes that they don't shut down and continue to operate at full power, and a fracture grows during that time. But, of course, if you shut down, that's going to curtail that growth, so.

For, again -- it's for smaller breaks, I mean for smaller piping breaks we expect to be able to demonstrate that no rupture will occur. And the net result is that we would not have to evaluate going to this analysis paralysis. I think that you coined the term in December, and we have thought about that analysis paralysis for a long time, and we certainly agree it's a very challenging domain to enter, so.

Now, because leak-before-break is only available at this point for PWRs, this framework while it could be expanded to BWRs, right now it's only applicable to PWRs.

Next slide, please.

So, this is a little thought experiment. If you think back, and I guess it's four decades or more when large break LOCA was initially developed as a hypothetical event, bound other design basis criteria, it essentially is almost an instantaneous rupture of the largest coolant line in sight, informing a double-ended guillotine break.

So, that is a scenario that I think we, listening to the discussion this morning, is certainly in question as to how, how realistic is that.

So, with the ALS approach, you would first see just, just as with the traditional approach, you would see flaws begin to grow. And they would grow over years or decades until they come through the through-wall crack. Small leakages will begin to occur.

The amount of fluid would increase and before it reaches the expect to identify the leakage level, which is 1 g.p.m., the operators would take action. It would show up in any number of parameters.

So, you would see core inventory balance changes, potential make up flow increases, sump levels increasing.

Containment temperature pressure, moisture particulate activity would increase, and a number of other phenomena could be observed.

And so, we have relatively small leakage indicated by a number of independent parameters easily detectable by the plant staff.

And this is desirable for this application because all, I think that we said all but one PWR has this already licensed and procedures in place, the equipment in place, the processes in place, the training in place.

And so, it's already working. So, it makes it a faster pathway for implementation.

So, the operator response for almost all plants tech spec requires you to go to Mode 3 and in 8 hours, and to go to a cold shutdown in 36 hours. There are a few that only go to Mode 4 in that last phase.

But even if you're only required to go to Mode 4, if you're going to investigate a steam leak in your containment, it will eventually cool down. And certainly if you're going to make any kind of major repairs, you're going to continue to cool down.

So in this condition, you reduce the pressure to the extent that the driving force to force a crack into a rupture, to a LOCA, has been removed. And so, you would not expect LOCA to occur in these conditions.

And then, finally, even if it did occur, the decay heat reduction and stored energy reduction is very quick, certainly much less than 19 months.

The temperature increase on the cladding would be nominal, and you would not expect FFRD to occur.

So, this is in my view a realistic sequence of events for what would happen with regard to break piping, not what we've been analyzing traditionally.

And so, in this scenario a large break LOCA would not result in fuel dispersal.

Next slide, please.

So, LBB applications there have been I don't know maybe a dozen or so. They are a little unique in their characteristics.

They focus on specific attribute of consequence of a LOCA. So, it's not broadly based. It's not everything associated with ECCS systems.

It's one specific performance parameter. We limit it to individual piping systems, or subsystems. You have to analyze the entire pipe but you don't have to analyze all pipes. And they're plant-specific qualified on a plant-specific basis.

And so, in conclusion with LBB analysis, is that they demonstrate that the probability that fluid is just a piping rupture, is extremely low.

So, we talked in June about the xLPR analysis. And the NRC talked about their own xLPR analysis.

That's a different and independent assessment, and reaches the same conclusion that large break LOCA rupture is extremely unlikely.

So, some examples where it would be is, has already been accepted or somewhat similar to our application.

There's an evaluation of fuel fragmentation due to baffle-former bolts. This is a different type of fragmentation. This is fretting driven, but it's a fuel cladding failure event nonetheless.

The exclusion of blowdown loads on control rod insertion, and thermal mechanical loads on the fuel structure integrity.

So, these are examples of other LBB applications that are somewhat similar to our proposed application.

Next slide, please.

So, there is a potential challenge to this methodology, and that is related the LBB policy on application to ECCS systems.

So, in '89 the NRC evaluated the potential to extend LBB to ECCS systems. And this is a quote from the Federal Register.

And essentially public comments, the industry did not identify sufficient safety benefits to merit the investment of time and resources for the NRC to extend this technology to ECCS systems.

Well, a lot of things have changed. And so, some of which are that many of the things that needed to be done, are in progress with this rulemaking.

Also, the value of the ALS approach is that it's already under review. And certainly going to be implemented much faster than option 2, or probably option 4.

And so, in that framework you wind up with a transition to high burnup fuel, which reduces the batch size, which reduces your discharge.

And so, your dry cask requirements are significantly reduced some for 20 percent. So, occupational dose to site workers who are managing these cask campaigns are reduced.

Site boundary doses are reduced because you don't have as many casks being loaded to the pad.

And when we get and I didn't put it in there, but when we get repository, the transportation risk with fuel casks to be transported, are also reduced.

Many of the PWRs cannot reasonably implement 24-month cycles without higher burnup, and so this would allow that to happen in a more timely fashion.

So, that reduces the number of outages by 25 percent. So again, that's this benefit of occupational dose and also a potential for site, for outage related risk is also reduced.

And y'all said it in December. This rabbit hole with chasing the, potential rabbit hole, chasing the dispersal effects is a potentially enormous burden on the industry, and the staff.

And the number of skilled, highly trained industry staff members who can do the kind of analysis and work that would be needed to be supported, diminishing all the time.

And so, this would fully tie, tying those individuals up. And so, they could focus on more efficient, I mean more safety significant activities.

CHAIR BALLINGER: Walt?

MEMBER KIRCHNER: Yes, I just wanted to underscore the presenter's point that once you get into fuel dispersal, the uncertainties are huge. The analysis, it would be your analysis applicant against the staff.

So, the question I really wanted to ask is, where is your transition for the PWRs you're looking at, in terms of break size where you think going to these advanced fuels, claddings, and higher enrichment, where is that transition point and break size where you will not likely see significant fuel dispersal?

MR. SMITH: Yes, so --

(Simultaneous speaking.)

MEMBER KIRCHNER: What size break?

MR. SMITH: Yes, so we didn't use exactly a break size. And we did it in a conservative way because of the uncertainties associated with the work when we began.

So, for the main coolant loop piping, hot and cold legs.

MEMBER KIRCHNER: Yes.

MR. SMITH: That would be evaluated under LPD. The branch lines and all smaller legs, would be evaluated using deterministic LOCA report.

MEMBER KIRCHNER: So, the first order is that comparable to what the staff's TBS size is?

MR. SMITH: I understand --

(Simultaneous speaking.)

MEMBER KIRCHNER: For PWRs?

MR. SMITH: -- that's similar, yes, it's very similar.

MEMBER HARRINGTON: Hey Walt, this is Craig. It maps.

MEMBER KIRCHNER: Yes, that's what I thought.

MEMBER HARRINGTON: Very close with. Not because of the intent, it just does.

MR. CSONTOS: That's why we brought up the point about defining TBS in the Rule, as opposed to in the guidance, that this approach, we'd have to have Legal review it like what could or couldn't be done it.

But we don't want whatever we do in that, to preclude the use of ALS.

MR. SMITH: So, couple more points on --

(Simultaneous speaking.)

MEMBER KIRCHNER: One more question.

MR. SMITH: Oh.

MEMBER KIRCHNER: If I may. I get the LBD part of it. How do you account for seismic events?

MR. SMITH: The xLPR analysis that we did included a seismic load at the end of each time step. And so, so that those seismic loads are factored into the capacity for the likelihood of the pipe to rupture.

And the sensitivity studies that were done showed that the seismic loads didn't materially impact the conclusion. So, it wasn't sensitive to seismic.

So, couple other points. The smaller batch size shrinks the entire fuel cycle, not only just the back end but the front end.

So, there are benefits to uranium miners who won't be exposed to alpha radiation from uranium dust.

Transportation risk throughout the front end of the fuel cycle is reduced because you're shipping less material around.

Oh, sure.

MEMBER PALMTAG: Hi, this is Scott Palmtag.

I just wonder if you can explain that a little bit better because when you have the lower batch sizes, your economy, your fuel economy is going to go down.

MR. SMITH: My fuel what?

MEMBER PALMTAG: Economy is going to go down. You're going to have some higher burnups, but your average, batch averages, are going to go lower.

MR. SMITH: Fuel economies will be better. Yes, so we published --

(Simultaneous speaking.)

MEMBER PALMTAG: Fuel economies will be better with smaller cycles?

MR. SMITH: Smaller batch size. Reduce the batch size by 20.

MEMBER PALMTAG: Okay, size of the batch.

MR. SMITH: The number of assembly is

roughly 20 percent less.

MEMBER PALMTAG: So when you go to a 24-month cycle --

MR. SMITH: A 24-month cycle --

MEMBER PALMTAG: -- you're still going to have three batches?

MR. SMITH: Well, yes, maybe two, but.

MEMBER PALMTAG: When you go to two batches, your efficiency is going to go down.

MR. SMITH: Yes, that's a separate decision. So, if you were going to go to 24-month cycles, the batches would go up but not as much as it would if you didn't have the higher burnup fuel.

So, higher burnup fuel reduces the cost --

MEMBER PALMTAG: Your ecos going to go up, but your averages are going to go down. It peaks with the 24-month cycle, your peak exposures will go up.

MR. SMITH: Peak exposures will go up for across the board. But they will not go up as much with a 24-month cycle.

Still, they'll go over the current 62 limit.

MEMBER PALMTAG: I'm not sure I agree with that. Every 24-month cycle I've looked at, your average discharge burnup's going to go down.

MR. SMITH: That's relative to an 18-month cycle, that's correct. But on a apples to apples comparison, if I have a plant that I can do 18-month cycles or 24-month cycles, higher burnup fuel on the 24-month cycle is going to be cheaper than lower burnup fuel on 24-month cycle.

PARTICIPANT: They do have a couple reports on that.

MEMBER PALMTAG: Yes, I have not seen that.

MR. SMITH: We can provide you those analyses. There was a NEI report and there's also an EPRI report that we can provide to you.

MEMBER PALMTAG: Every 24-month cycle I've ever seen, your fuel costs are going to go up.

MR. SMITH: I agree. If you compare an 18-month cycle to a 24-month cycle, it goes up. And if you compare a 24-month cycle with current burnup to a 24-month cycle with a higher burnup, costs go down.

MEMBER PALMTAG: I'd like to see that when you have it.

MR. SMITH: Okay, certainly.

And so to that point, after you look at that report the fuel costs go down and plants that may be marginal economically, would have more margin and we can provide more assurance that we can continue to generate carbon-free energy for the country.

So, next slide, please.

PARTICIPANT: Do you want to talk about the ECCS policy?

MR. SMITH: No, let's forget that.

So in summary, the large break LOCA-induced FFRD is extremely low likelihood of occurrences, supported by NUREG-1829 as we talked about today already.

The xLPR analysis that we performed, and also that the NRC performed and discussed in December.

The LBB pipe qualification process using a different deterministic method, reaches the same conclusion that the probability of rupture is extremely low.

There are multiple layers of defense with this approach. So you begin with the basic system design material selection, pipe geometry, et cetera.

System fabrication, QA program, welding procedures, qualification, inspection, et cetera.

NSSS, nominal and admirable operating procedures that limit pipe system loads. In-service inspection that we talked about today.

And leak rate detection. So, leak rate detection is a key feature. We have many months to detect a small leak.

That leak would if undetected, would become more evident because the leak would increase gradually.

Our results show that increase is fairly linearly until it gets near rupture condition, then it accelerates.

And so, the methods of detection and multiple independent methods of detection, we did not include a HRA-type analysis of the detection because the results, the HRA methods have a minimum risk and won't go below a certain level, N to the -6.

You would have blown through that so it, to us, the 19 months and a tech spec in place using independent methods, it appears self-evident that it's virtually not credible that operators would miss this and not shut the plant down.

VICE CHAIR HALNON: Fred, at 19 months, can it be 24, 25 months? Because the Davis-Besse, granting it was a lot of other indications should have been seen, I get that. But it was 24-month cycle.

MR. SMITH: So, the 19 months is a 95/95 lower limit on the results of samples, sampling in probabilistic methods. It's the PR Monte Carlo type method.

So, many of the scenarios would be that, but the Davis-Besse issue, there's a lot of changes in the industry and certainly I count on those changes personally to protect.

VICE CHAIR HALNON: Okay, I don't disagree with you. The V.C. Summer at 18 months, it was not detected in any way except for that last one.

MR. SMITH: No.

VICE CHAIR HALNON: And so, a lot of times is that you've got to be careful of.

MR. SMITH: Yes.

VICE CHAIR HALNON: And for taking credit for all those, you said independent and I'm glad you said that, but they are dependent and somewhat because it's all people looking at them.

MR. SMITH: Yes, and multiple people unidentified leak rate detection in a plant, you know how important this is.

It's a morning report. The industry guidance on it shows you, tells you that you begin looking at the leak rate when it's the 10th of the tech spec limit.

And you trend it and so, the procedures that implement this LBB tech spec, are very, very well thought out.

VICE CHAIR HALNON: Yes, it's been a while since I've done a leak rate, but we also are very good at rationalizing it if it was coolant leakage or something else, so just saying.

MR. CSONTOS: Yes, much has changed in the industry since Davis-Besse and NEI 03-08, aging management. There's a lot of things that have gone on.

We've worked on them for decades now to recover from that. Because of.

MR. SMITH: Next slide I think is maybe the last. So --

MEMBER ROBERTS: Fred, to understand ALS versus what the draft rulemaking is obviously a very large amount of similarity. They're both predicated on there being a break size above which is highly unlikely.

And so, some degree of relaxed requirements is appropriate.

So, it seems like ALS, the difference is ALS does not use the beyond design basis for proof for the existing requirements, just adds to the LBB provision for FFRG.

And so that way, it's more conservative than the staff proposal. The staff proposal would require an assessment and analysis, which you don't do because you use the LBB and leverage that.

Is that a fair summary?

MR. SMITH: Yes.

MEMBER ROBERTS: So, if there was a subset of assessment analyses that supported no dispersion criteria and consequently further support the ALS approach, or would also support the staff's approach.

Is that right? Did I get that right?

MR. SMITH: Yes, yes, you're right. The ALS is not equally applicable to 50.46 and 50.46a. It doesn't require and of course we're not opposed to 50.46a, but it doesn't rely upon it as a basis. But if both were implemented, there would be some additional defense-in-depth.

MR. CSONTOS: Okay, what we wrote in the letter, the second letter that I had on the summary chart of my slides, was that we're pretty consistent that what we said is that to be more realistic, okay?

When you're talking about these large beyond design basis type of considerations that we're talking about here, the large break LOCA, we wanted to think about it in a more realistic manner.

I think that if we go at it in a more realistic manner like in terms of this case, what a realistic flaw would do in terms of how it would really progress and not just this double-ended guillotine break, that we can now see there's value, significant value out of that.

And to getting more (telephonic interference).

MEMBER ROBERTS: Yes, thanks. I also gathered Al, what you said that the ALS wouldn't really help with power uprates for plants that are limited by a large break.

And so, you wouldn't --

(Simultaneous speaking.)

MR. CSONTOS: Yes, your right.

MEMBER ROBERTS: -- just stick with ALS. Because at least as currently proposed, that only deals with FFRD, not with a desire for power uprates.

MR. CSONTOS: Correct.

MEMBER ROBERTS: So you would need something like what the staff has with those options.

MR. CSONTOS: Or option 4. That was the other alternative 4 was one of the other options for us that we considered. And we wrote it all in that letter.

MEMBER ROBERTS: Okay, thanks.

MR. CSONTOS: We may need to think about the policy. There's an uncertainty, there's another uncertainty in this, which is the policy considerations.

And we can talk about that later. We're unsure where the staff is at this point with the, with respect to needing a policy change, or not.

And so, that's the only thing that's out there that's a risk mitigation that we need to think about in the future, to adopt ALS.

CHAIR BALLINGER: I have a question, and that is for, what is your opinion as to the long pole in the tent for option 2?

MR. CSONTOS: I think that what you all talked about in December, is what our concerns are, okay? And in particular, it's about this analysis paralysis.

We really like that term, because what we get is the same thing that we saw with the three flow charts that were discussed this morning.

It's in a similar vein where each of those boxes are a staff determination of whether you have complied or not, or you met what they were asked for.

Now in some cases, we don't know what the 1428, is it a check box or if it might, what level of detail.

But we heard today about stresses and are we going to have to come with you with multiple stress analyses, residual stress analyses or whatever it is, that you have to go through to get approved, okay?

CHAIR BALLINGER: But you may have to go for it. There's a short circuit around each one of those things.

MR. CSONTOS: That's right. And so the question is, is that there's a part of this that you take a look at and you see what is that implementation.

Have we taken a look at this to see whether or not we can take what the staff has provided, and go through and find a stable and predictable path to getting SER done. And LAR approved for that.

Right now, we're very uncertain about that, and that's what you heard this morning.

CHAIR BALLINGER: Yes, for everybody.

MR. CSONTOS: Right. And that's the ultimate, because everyone's on a schedule and on a clock. And in a lot of cases for regulated utilities, they're on a clock with their PACs, okay?

So, this is where there's a plan and if we have an uncertain path, and that's the whole point of the advance act is to try to get us to a more efficient path here. And predictable path.

And that's where we are right now. And that's why we're coming to you to talk about these concerns that we have.

Again, many of these could be fixed in a workshop meeting. We're not sure. But at least we came to you to describe what the utility concerns are.

And one other thing I forgot to bring up that we could also have four utilities tell you that they want ALS.

But if you want to, we can also have them at the end, we had that also out there so to tell you that they would like it.

So, if you want that, we can do that. If you don't, it's no big deal.

CHAIR BALLINGER: And lastly, so we have the long pole in the tent. Is it too long?

MR. CSONTOS: I would say the way we wrote the letter, the second letter on the Reg basis, provided that concern.

We were very concerned over option 2 being something that was near-term deployable, or able to deploy.

And so, we really applaud the staff for going forward with alternative 2 because that, we think that could probably solve a lot of things.

But the concern again is implementation, and implementability if that's a word of the, of the REG Guide, that the draft guides, but also the rule itself and moving forward with that in a timely way.

MR. SMITH: Let me ask. So Kevin said that we don't yet know, we don't yet know what a true best estimate LOCA is.

MR. CSONTOS: Right.

MR. SMITH: And so, we don't yet know whether or not if it's a sufficient margin to carry the whole PWR fleet forward.

Certainly, it would be better results, but you may still have plants that would have dispersal and would have to deal with this analysis paralysis issue.

MR. CSONTOS: What is best estimate? I mean, each reviewer has different perspective on that. And so, that's the concern that we have is that we are just not sure what it will take.

And that's really the uncertainty of this licensing path.

CHAIR BALLINGER: I mean, I'm looking at REG Guide 1.157, which has the title, best estimate calculations for emergency core cooling system performance.

I don't know. Doesn't say true.

(Simultaneous speaking.)

MR. SMITH: I think Jeff would like to comment.

MR. KOBELAK: Yes, Jeff Kobelak, Westinghouse.

I would say REG Guide 1.157 defines best estimate in the context of best estimate plus uncertainty.

CHAIR BALLINGER: Yes.

MR. KOBELAK: And those calculations are still done typically to a 95x95 level. If you reel that back to kind of what we call true best estimate, I would say there's a very substantial benefit and difference between those two outcomes.

CHAIR BALLINGER: So, what's your definition of true?

MR. KOBELAK: I think it goes back to the slide Paul presented where everything is most likely expected operating conditions, nominal midpoint of range, 50th percentile, not 95x95.

CHAIR BALLINGER: Okay.

MR. KOBELAK: I did also want to clarify one other point. I think there was a question earlier about if plants want to operate, would they need the

50.46a versus ALS. And I would say most plants are not large break LOCA limited for operate. So, I do think a vast majority of the fleet could operate with ALS and not need that 50.46 outcome.

Thank you.

MR. CSONTOS: And we did talk about best estimate, and we referred it back. So, in and I can't remember which letter it was.

I think it was the first letter back in March, we did highlight that a small change in a couple words in the prior 50.46 output, made the Rule go from usable to unusable, or unimplementable.

And we wrote it in that letter, and we talked about it, and with respect to going from one criteria to I believe it was higher level of best estimate plus uncertainty.

And so, originally it was written in the full package as a certain I can't remember what the word was, but it was written in a certain way.

And in the last final stage, it was changed, added a couple words in there and then all of a sudden it went to well, no, no one's going to implement it now because it was just too, too onerous.

And so, that's the kind of thing that caused that Rule to not be used. So but again, I would just, it's been a long time; it's been years.

CHAIR BALLINGER: There is a true, there is a path, I'm going to use the word true. There is a path to true best estimate.

MR. CSONTOS: That's what we're hoping for.

CHAIR BALLINGER: It's not a iterative loop that's going to happen. It would happen for months and months at a time.

MR. CSONTOS: And we suggested that in the letter. And reiterated it here.

CHAIR BALLINGER: Well, other questions from members? I don't see Walt's hand up. I sort of expected it, but.

MEMBER KIRCHNER: I'll take a bye at this point. Thanks, Ron.

CHAIR BALLINGER: Okay.

Okay, we've succeeded in putting ourselves --

(Simultaneous speaking.)

MEMBER PETTI: Ron?

CHAIR BALLINGER: -- right back on schedule. Trouble is we're in the wrong --

(Simultaneous speaking.)

VICE CHAIR HALNON: There's one more.

CHAIR BALLINGER: Oh, Dave? I don't see any hands.

MEMBER PETTI: Sorry, I didn't raise it.

So, just one question that maybe the industry folks can answer in terms of these power uprates.

When I think about moving large break LOCA to beyond design basis, I think about that there's going to be huge margin to peak clad temperature. And I might want to increase the linear power and get 10 percent more out of the reactor.

Is that an unrealistic? I understand there may be changes outside the core to make that happen.

MR. CSONTOS: Baris, do you want to answer that?

MR. SARIKAYA: Yes, the linear regeneration rates does not real, all solely depend on the LOCA response.

We would get benefit for the things like FFRD resolution, however, in order to change the linear regeneration rate, you need to look way beyond LOCA.

One thing that also that I like to remind everybody that not every plant is large break limited. So, half the BWR fleet is small break limited.

Therefore, it's not going to be a flat path to improving thermal limits. The only plants that I can think of benefit the way that you're talking about are the currently LOCA limited plants. LOCA set down plants.

That they have significant set down and then they are large break limited, they may benefit from this.

But other than that, the rest of the fleet, they cannot go beyond their currently approved thermal-mechanical limits. Not just because of LOCA but other reasons, as well.

MEMBER PETTI: Okay, my question another way is if I take this off the table, what limits the design? And the answer is it really depends, right, I guess. There are other transients that do that, that limit things.

Okay.

CHAIR BALLINGER: Okay, like I said we're exactly on schedule except we're in the wrong topic.

MEMBER PETTI: Ron, you really got to do a better job of managing.

CHAIR BALLINGER: Well, but you know, I made it to 3:00 and it's time for a break. Kidding aside, we have plenty of time. There's a lot of, we're having discussions that we would have had anyway.

So, I would propose that we take break until 3:15 and then what happens next is this sort of more or less open discussion amongst the members and the staff, and whoever else we can ask, related to the what we thought were open, not open items but items that we needed to have further discussion on from the December subcommittee meeting.

So, that would be the plan going forward, so we will please come back here at 3:15.

(Whereupon, the above-entitled matter went off the record at 2:59 p.m. and resumed at 3:15 p.m.)

CHAIR BALLINGER: Okay. We're back in session. And now we're at the point where we go back and forth a bit on the list of issues which were identified based on the December subcommittee meeting. And I would propose that while that little one-pager we have doesn't match the order that's on the screen, then we just stick to the order on the screen for other people in the room that don't have this page. And so Dave, do you want to do something? Or should we just wade into it?

MEMBER PETTI: I think just the first two, I didn't have any -- I don't think anybody had comments on --

CHAIR BALLINGER: Yeah.

MEMBER PETTI: -- this. But once we get to three -- to four, I think we can have a more directed discussion with each of us --

(Simultaneous speaking.)

CHAIR BALLINGER: Yeah, I think three we've done --

MEMBER PETTI: Right.

CHAIR BALLINGER: -- unless other members want to continue that discussion. Four is an important one.

MEMBER KIRCHNER: Ron, not to regress, but number two --

CHAIR BALLINGER: Sure.

MEMBER KIRCHNER: -- we did kick around why the 10 percent knowing that there -- this is primarily an LWR focused rule. I understand that. But knowing that advanced reactors are coming and these changes are outside of 50.46a which is the focus, the acceptable ECCS performance for LWRs. The changes to 71, for example, I just don't understand why that wouldn't be changed while the staff is doing it to 20 percent.

CHAIR BALLINGER: Yeah, I think that question was actually asked pretty directly in December. So is there somebody that can address that,

that's on the staff?

MR. PIOTTER: Jason Piotter, I'm with NMSS. So just for everybody's recollection, the original staff recommendation for this was to not pursue rulemaking at all. And the primary reason for that is 71.55(c) has a provision in it that would allow for approval of fissile material packages with no enrichment limit.

So that rule already exists. What's required there is a special design feature so that no single package failure results in a leakage. So you'll note, sodium 155(c) and with (g) which is the one that's specific to UF6 packages, both are focusing on leakage of moderator into the containment space.

From the staff's perspective, we did get public comment that suggested that LWR level enrichments that would be expected for ATF in the 7 to 8 percent range would be helpful for industry right now. So in light of that, in light of the ADVANCE Act, the staff had some discussions to determine what would be an appropriate incremental approach to support those LWR producers in the near term given that we do have a certification pathway already encoded in the regulations in 71.55(c). We do have a question, however, as part of this draft rule requesting input from the public and from industry if they can provide us additional information for those enrichments in the 10 to 20 weight percent range that would be beneficial for them if they can provide us a basis for that as well.

One other thing I do want to note, we've already approved a fissile material transportation package for UF6 enriched up to 20 weight percent. So there is an existing package already. It used 71.55(b) meaning that it included the moderator inclusion as part of that approval.

The delta there is that because it's using moderator inclusion, there's a moderator present. The total payload capacity ends up getting reduced. And that's really the driving factor here really is when you get to a transportation campaign for this material, if you can only transport somewhere between 55 percent and 64 percent of what you might otherwise be able to ship.

And this is on a first cylinder basis, not a per conveyance basis. Then you would have to have more transportation evolutions with this 20 weight package that's already been approved. So the basis behind the 10 weight percent was a starting point, not necessarily a finishing point.

And it really had to do with the fact that we didn't want to be redundant in creating an additional prescriptive rule that was not technology inclusive which is what 71.55(g) is. It's not technology inclusive because it's specific to existing technology. We didn't want to stray too far from what we already had in addition to recreating a redundant regulation.

CHAIR BALLINGER: Is that good enough for you, Walt?

MEMBER KIRCHNER: Yeah, thank you.

MEMBER ROBERTS: I was wondering if you could provide perspective on the incremental risk between 5 percent and 10 percent.

MR. PIOTTER: So we haven't actually done the calculations in terms of what it looks like in terms of overall risk. And I think part of the issue there and I'm glad you actually brought the question up. We're moving toward in Part 71 at least a partial consideration of a risk framework.

I know some of you probably -- and if not all of you have listened to the microreactors presentation on the transportation risk framework. Ideally, I think over time, we would look at that. But we just made the assumption from the get-go that as you move up in enrichment, your criticality consequences increase.

Your risk increases. We didn't actually do a calculation to determine what those values are. I think if we were to look at this more -- in a more fulsome way, particularly if we had to start looking at moderator exclusion on a bigger scale.

We would have to start looking at that from a risk perspective and start doing some calculations on that front. But even if you go back to the original promulgation of 71.55(g), there was not -- that did not do any sort of risk-based analysis to put that 5 weight percent value in there. It was standard practice at the time.

There were public comments, not unlike what we're receiving now that we should just go up to a higher enrichment level, whether it's 10 or 20 weight percent. Staff at the time didn't feel like they had enough technical basis with respect to critical experiments, for example, to be able to justify going above 5 weight percent at the time. Similarly now we're in a similar situation where if you go above roughly about 10 weight percent doing the calculations, we don't have enough critical experiments for dry UF6 that are really going to give us a lot of confidence in what our criticality calculations are going to show which is going to have to result in more conservatism as it relates to setting the values of the payload capacities.

MEMBER ROBERTS: Okay. Thank you. So the 20 percent enrichment, there's no moderator exclusion assumption. So if it's poison -- the container is poison --

MR. PIOTTER: Correct.

MEMBER ROBERTS: -- to preclude criticality at 5 percent. There's a historic requirement that says you don't have to worry about that. And all you've done is extend that to 10 percent with an initial defense in depth requirement?

MR. PIOTTER: Correct. And again, because the focus is on whether or not moderator can get into the package or not, that's why we try to continue that same line of thinking with the expansion to 10 weight percent rather than to try to make an argument on a risk perspective with respect to criticality.

MEMBER ROBERTS: All right. Thanks.

MEMBER HARRINGTON: This is Craig Harrington. In the rulemaking package this table is for, it's 8 percent. And I couldn't find much discussion explaining why the difference and what the implications were and is that temporary. Can you speak to that?

MR. PIOTTER: So that's actually outside of my particular area. But it did get asked as part of the concurrence process from my portion. I don't know if Don Palmrose is on the line to answer that particular question. I can speak to it generally.

MEMBER HARRINGTON: He left you on your own.

MR. PIOTTER: That's fine. And this is the environmental piece of --

CHAIR BALLINGER: We don't have phone a friend here.

MR. PIOTTER: That's okay. I'm sort of used to it at this point. With respect to that, essentially there was a guidance document that had come out that basically limited the value that they were evaluating up to 8 weight percent. It was necessarily there was a disconnect between what we're doing at 10 weight percent and what they're doing in that table at 8 weight percent.

It just, I think, happened to be a coincidence of timing and how that guidance document was developed in picking that 8 weight percent. Now what I would mention is the public comment we did receive for the 71.55 portion of this. I think it was

7 or 8 weight percent was the value that we were quoted.

And I think that's roughly the limit that we expect to see is the 7 to 8 weight percent. Since we're talking about nice, clean cutoff points, the 10 weight percent was the limit that we picked. But there's not necessarily a connection to that 8 weight percent limit piece. And so I can see how it looks like there's a disconnect there. But they are, in fact, a disconnected activity.

MEMBER HARRINGTON: Does that make it practical to ship it at 10 percent?

MR. PIOTTER: That's a question we'll have to take back. But I think your question is certainly a valid one. And it's one that we've been wrestling with our senior management as we're going through the concurrence process.

CHAIR BALLINGER: More questions about this topic? And I think we're basically discussing one and two.

MR. PIOTTER: I don't know if Charley is online. Charley is remote. And so the 50.68 item was his.

MR. PEABODY: This is Charley Peabody, NRR, Division of Safety Systems. I'm doing the 50.68

question on the rulemaking if anybody has any questions or discussions on that.

CHAIR BALLINGER: What is 50.68?

MR. PEABODY: Criticality.

CHAIR BALLINGER: Oh, that's the criticality part?

MR. PEABODY: Yeah.

CHAIR BALLINGER: Okay.

MR. PEABODY: Yeah, I think there was only one question that was on the paper that was circulated that I saw. And that had to do with why we're making it an option between the existing 5 percent enrichment limit and the value specified in the operating license rather than just making it the value specified in the operating limit or doing away with that E7 requirement entirely. The reason for that which I did mention in December, the BWR standard tech specs offer two methodologies to comply with the criticality safety requirements.

One of them has an enrichment limit and the other does not. The k-infinity one does not have an enrichment limit. So that's essentially why we opted to keep the enrichment limit because the BWRs would then not have a specific regulatory limit if we took it out of the rule. We still -- the staff still feels based on the research that you can use either the k-infinity or the k-effective plus the enrichment limit method and still apply that with the higher enrichments under the proposed rule.

CHAIR BALLINGER: Yeah, nobody is going to fess up to that. Other questions or comments from members? I'm not sure who -- it's not on our list. I'm not sure which member -- maybe, I don't have the detailed one with me. I'm not sure which member commented. But since nobody is on that, I think we're done. Okay, okay. Now --

MEMBER ROBERTS: I think I had a comment. I've already discussed that with Jason. The observation I had last month, again, just for your consideration is 75.155(c) is written, I think, pretty well in terms of it gives you a performance-based requirement. The slide where we shown was protect the valve as opposed to having a performance-based requirement and show that there's no single factor that can cause leakage. So it's something to think about is to have the language be more performance-based and not be so specific to a particular configuration.

MR. PIOTTER: Understood. Thank you.

MEMBER ROBERTS: And I understand what you did, the comparison to Part C I think answered my question.

CHAIR BALLINGER: Okay. Now the bigger one, FFRD. There you go. There you go. And yeah, so --

MEMBER PETTI: Let me lay out the three major comments. This is Dave. The idea of having a hard line of no burst as opposed to what's there now which I agree is flexible. But it's a slippery slope.

And the second is we've talked about it a little bit on best estimate definition and industry's concern. We also raise that. And then the issue of core degradation and the definition and consistency of the definition in other parts of the rule compared to what's in the new rule -- new parts of the rule.

Those are the three areas. So why don't we start first with the no burst. At least what I'm hearing is that they think no burst is doable for at least the PWR reactors.

And opening the door to allowing some relocation and dispersal is just fraught with a calculation uncertainty. And although I appreciate wanting to be flexible, it can be viewed as a trap, I guess, in the worst case, right? You get going and then you find out you can't get where you want to go.

MEMBER KIRCHNER: Well, compared to -- Dave, compared to the requirements for DG 1428 and the commentary that we had, paralysis by analysis or vice versa, going into dispersion of fuel. And that is a much, much more difficult region to enter with any kind of evaluation model that would be comparable to what's currently used for ECCS evaluations. I mean, it's the stochastic nature of the burst, the amount of material that is dislodged and dispersed, where it winds up.

I mean, you get to orders of magnitude, complexity and uncertainty vis-a-vis a nominally intact geometry. Just so it becomes a major analytical challenge. And then both for the applicant and for the staff, it's your analysis against my analysis. The degree of uncertainty is just use. So I throw that out as not insurmountable but as a caution.

MEMBER PETTI: Well, and you weren't the only one. I'd say there were at least four members that had concerns around this area. So this is going to be in our letter just because I think there's such a strong consensus among the members.

CHAIR BALLINGER: I would mention that we wrote a letter on the RIL quite a while ago. And that was also one of our concerns then, uncertainty and things like that. So it's been a topic that we've been mentioning quite often.

MEMBER MARTIN: This is Bob. I think there's also -- there's a backfit question, right, that's come up earlier. There are analyses or up to 62 gigawatt days per metric ton that have burst, right? We've accepted that.

The RIL back in the day said it wasn't -- these weren't significant issues. Whether it was accurate or not is debatable. It adds burden and adds this to the industry, these people that rely on analyses and support their licenses that have these results.

I had to reflect my opinion. I think below the 62 threshold is not as much of a safety issue as it is above. And you can draw a hard line that above a certain level, we go with -- you recommend no burst.

I mean, that's the easy button in the presence of the uncertainties maybe that still exist. But at the same time, we've been under a different paradigm. And I think the research kind of supports that's probably okay and in a more holistic view of safety.

MEMBER PETTI: I also think, Bob, that the saying, no burst, it also takes that question of what about we've already licensed reloads that go to 62. And you're saying 55 is the starting point. It would just take all that off the table. It'd just be a cleaner licensing approach. Just my opinion.

(Simultaneous speaking.)

MEMBER MARTIN: I don't think you raised that. Cleaner wasn't really my issue. It is cleaner. I would agree to that.

MEMBER PETTI: Yeah.

CHAIR BALLINGER: Some of our accident analysis allows burst. But at the time, we didn't anticipate dispersal and the like. And now we have new data that says, well, if you burst, you can get dispersal under certain sets of conditions. So that argues for the no burst if you can do it.

(Simultaneous speaking.)

CHAIR BALLINGER: But the way things are drafted -- go ahead, Dave.

MEMBER PETTI: The best estimate should drop those temperatures so that you're not going to burst, assuming we can get a good definition of best estimate.

MEMBER ROBERTS: And that gets to the question we're talking about -- the interview is talking about there in the last session which what do we expect to get for best estimate analysis? Part of it is what is the best estimate analysis. And then do we have a sufficient range of best estimate analyses once we get a prescription to say, okay, we're competent that a no burst criteria is suitable. And that's the unknown at this point.

CHAIR BALLINGER: But we've seen some analysis by a particular vendor which has a no burst criteria. And as far as we can tell, it worked and we're okay with that.

MEMBER ROBERTS: Right. And I found the 1999 and 2005 analyses should significant margin to burst.

CHAIR BALLINGER: Right.

MEMBER ROBERTS: A best estimate basis burst, whatever they were doing, use for best estimate 25 and 20 years ago. So there's some history that you can get there, and if the staff were to impose a no burst criterion without having that information, that would be a potential showstopper in a different way.

VICE CHAIR HALNON: Again, you know more about this than I do. These plants that are small break LOCA limited if this criteria or this FFRD caused them to suddenly switch to the large break LOCA limited because they have additional issues they got to deal with. That could be a significant issue from the standpoint of how you operate your systems and tech specs and other things that you take care of. Doesn't mean you don't have to enter the LOCA. But I don't know what the --

CHAIR BALLINGER: Is there anybody on the staff that can speak to that?

MR. MESSINA: I think it's a -- Joe Messina from the staff. I think it's a very plant specific question.

MEMBER MARTIN: This is Bob Martin. When it comes to what's limiting, it's always been a bit of a whack-a-mole with methods. And again, to Joe's point about plant specific, each plant has its own association with a vendor or maybe some do it themselves. Methods are unique.

And some are more modern than others. And so there's always an onus on the utility and the relationship with their fuel vendor to balance the economics of all these things. But if they, of course, continue to push for more, whether it's more power, longer cycles or what have you, it does put that burden on methods.

And I know some of the fuel methods are ready for this and some are not ready for this. So there's going to be continued development. So the answer is a definite maybe.

CHAIR BALLINGER: So what I'm hearing is I have to write a letter or somebody has to write a letter. And that is that no burst is preferable. But if you can't do that, then you need to be careful.

The analysis is going to become a lot more complicated. Not undoable, but a lot more complicated. So that's just what you're saying?

MR. MESSINA: Yeah, and in 20 years, maybe there's a lot of research where they could track particles all throughout the RCS. I don't know for sure. But --

CHAIR BALLINGER: But the EPRI folks did say that they're doing research to explore this. I don't know what that means in terms of actual experiments or calculations or what. I don't know if the EPRI folks are here.

MR. MUFTUOGLU: Kurshad Muftuoglu, EPRI. So the current research is looking at the transport into the containment and where the particles will be collected and not necessarily how they are cooled and particularly what's in the primary system. So there's ongoing research on that part. You want to ask more?

MEMBER MARTIN: I couldn't hear what you

said.

CHAIR BALLINGER: What I heard was -- or I think what hear that you're doing analysis or experiments related to -- at least to the containment -- transport to the containment, not so much the nitty-gritty of burst pressures and all this kind of stuff. Is that right?

MR. SMITH: This is Fred Smith from EPRI. You're mostly right. We're looking at particle transport within the fuel, so to spacer grids and on.

CHAIR BALLINGER: With respect to bursts. Some of us have been around long enough, Steve in particular and myself, to know that these burst tests have been going on since --

DR. SCHULTZ: '70s.

CHAIR BALLINGER: -- the '70s. And to this day --

DR. SCHULTZ: Early '70s.

CHAIR BALLINGER: And to this day, nobody has ever been able to correlate a real thing. They can do burst tests. But after that, they kind of look at it and toss up their hands. So it's not an easy thing to do, to get something this quantitative that you could use for an analysis, right? I mean, it's tough.

MR. MESSINA: I will say a lot of models today do have polluting and burst models.

CHAIR BALLINGER: Oh, they all do.

MR. MESSINA: Yes, exactly. And NUREG-630, it's old. But it still can be used.

CHAIR BALLINGER: Right. If we ask the people that did 0630 what the uncertainty was.

MR. MESSINA: No, it's -- those lines are interesting.

CHAIR BALLINGER: They go blank.

DR. SCHULTZ: This is Steve Schultz. Those evaluations don't tell you what happens to the fuel after the burst. It just tells you that the burst occurred and here's the size of the burst.

MR. MESSINA: Yeah, and I guess the Studsvik testing in the SCIP projects would come into play.

VICE CHAIR HALNON: So this is Greg. Why don't we ever talk about what happened to TMI-2 and the fact that a third of the core burst and turned out okay? I mean, and I know okay is a relative term.

MEMBER HARRINGTON: A really bad day.

VICE CHAIR HALNON: It was a bad day. But it was frugal. It was transported throughout the RCS into a containment basement. I get it that it only had 90 EFP days, if that. But it certainly showed where it was going to go. Can't we bound this and say --

(Simultaneous speaking.)

MEMBER KIRCHNER: You can bound it. That's what MELCOR can do. Not the dynamics and the stochastics of how a core would melt down and so on. But yes, it's coolable, Greg. But can the industry have that as a design basis accident? No, I don't think so. It would set the industry back on its heels.

VICE CHAIR HALNON: It's more of a qualitative argument why it's okay --

(Simultaneous speaking.)

MEMBER KIRCHNER: Yeah, so coolability of a debris bed is probably not the issue. It's the intractability of saying what happens once you get to a large scale disruption of the core. I think we have reasonable confidence about you can terminate the event.

But you're now in a very severe accident state. And nominally, the 50.46a was to prevent large scale disruption of the core and maintain coolability. And that coolability definition is going to be stressed in this rulemaking.

MEMBER PALMTAG: And it considers the

economics. If you have burst, your plant is done. If you could non-burst, you can recover without really any safety issue. Maybe it is something to consider another reason to have the non-burst criteria.

I just want to follow up with what Bob started on is right now the dispersion happens at 55, right? We say it's okay to 62. There's a little check with units.

CHAIR BALLINGER: Dispersion doesn't happen. Fragmentation --

MEMBER PALMTAG: Fragmentation happens.

CHAIR BALLINGER: Fragmentation and relocation happens. You have the burst to get dispersion.

MEMBER PALMTAG: So the fragmentation happens at 55. Currently we're ignoring that up to a rod burnup at 62. But that is the rod burnup which you can have a LOCA burnup at 70.

CHAIR BALLINGER: But I think we're actually ignoring anything until the clad burst.

MEMBER PALMTAG: Well, the new rules will go in effect over 62 it's my understanding.

CHAIR BALLINGER: Right, but the clad has to burst first.

MEMBER PALMTAG: Right. Whatever we do,

though, I'm not sure why we can say it's okay over 62 and not between 55 and 62. If it's a safety concern, I think it is. I think we need to cover the range where it occurs.

And I realize there's going to be pushback. No one wants to forfeit rules. But if it is a safety concern, I think we have trouble ignoring between 55 and 62. I should be ignoring between 55 and 70.

MEMBER PETTI: And that came up in the RIL when we heard that because that was discussed which is I like no burst because it just cleanly handles everything.

MEMBER PALMTAG: No burst, yeah, I agree completely. I confirm no burst. But it would put some limitations below 62 which we currently do not have now.

MEMBER MARTIN: This is Bob. We were talking a moment ago with regard to -- and we can maybe transition to the best estimate -- definition of best estimate. For the most part, the missing information here for us is that none of us have any experience with whatever true best estimate is.

Folks in the room, online, we apply the methodologies. The methodologies have the biases. And they give us -- biases are intuition about what really happens. Now if we come in with a definition of best estimate, and mine is not going to be as articulated earlier -- I'm sorry. I'm missing your name over there.

MR. KOBELAK: Jeff.

MEMBER MARTIN: Jeff, Jeff, Westinghouse, right, has said. But nonetheless, I think the big hitter with these analyses and large break in particular is like single failure. It's huge.

And maybe that by itself or just initial conditions in general might solve the 55 to 62 issue. But we don't know. We don't know that unless someone goes off and starts playing around with the codes.

And I don't know if that requires -- I mean, I guess all would be methodology changes coming in with their post-TBS methodologies crediting. But I will say since I'm here and I'm talking about best estimate, Reg Guide 1.157, 98 percent of it is about phenomena uncertainties. And I absolutely believe that you retain phenomenological certainties in these analyses that you don't look at 50/50 as being the metric.

You still look at a 95/95 with these phenomenological uncertainties because that is the uncertainty that remains that you cannot do any better with. We can say stuff about single failure and initial conditions. And we've got lots of data of how plants operate.

We have a lot of confidence. We can never say anything really about the phenomena to the extent the state of knowledge in any one of those phenomena today. And to be honest, there's plenty of precedent in beyond design basis of considering phenomenological uncertainties at 95/95. The labs do it. I can tell when I was at Framatome, I did it.

MEMBER PETTI: But Bob, that's inside the design basis. I completely agree with best estimate plus uncertainty. When you go beyond design basis, I don't understand the rationale to go with best estimate at 95/95 as opposed to pick the mean or the median of the statistical analysis.

MEMBER MARTIN: The rationale is that it's the uncertainty range. And as much as we like to think we understand all these phenomena to a great extent, we only understand it to the extent of the uncertainty models that we have. And it's still realistic.

And the rub here is what's best estimate, what's realistic. And I'm leaning towards realistic. What's within the realm of possibilities. And then you still cover yourself for those things that are kind of out of your control.

You put best estimate of what you can control and you stay realistic with what you can control. And we can't control the laws of nature. You can control the operations of power plants.

MR. MESSINA: So by best estimate in this rule, we do not mean 95/95.

MEMBER MARTIN: I know. Well, I mean, you were ambiguous and that's why we're debating this.

MR. MESSINA: Yes, almost intentionally ambiguous to possibly allow for different ways to do this. Someone might want to be a little more conservative in how they do their --

MEMBER MARTIN: But I would say that's unprecedented outside of universities and labs because I think so. When I was considering accidents where it was AREVA, we considered 95/95. This is before USABR. And it continued for other plans that came along which, I mean, never going anywhere.

But nonetheless, we considered uncertainties of severe accident phenomena and then did the statistical analysis at 95/95 and those set boundaries for design. Now granted, they're not setting design basis requirements on safety-related SSEs. It's a lot easier to apply those kind of constraints. But there's precedent. And to do a straight up best estimate, there's too much subjectivity for that.

CHAIR BALLINGER: Well, we heard -- one of the presenters, I think, talked about what it would take to define what best estimate is as part of the discussion. So that -- if you can agree on what is best estimate, then that provides certainty for the applicants. And that is something that probably should be done if you're going to do that.

MEMBER PALMTAG: I agree with Bob, though. What a best estimate is, I mean, it's inherently subjective, right? There's lots of knobs, lots of tunes, lots of different correlations.

What's best estimate for Bob may not be best estimate for me. When you do best estimate, you have to include uncertainties. Now whether you take it to 95/95, that's different.

But I do think best estimate doesn't make sense unless you have some sort of uncertainties in there that just sort of limits you on your choices on what you can make that you have to include. The other issue I have with best estimates is how do you define best estimates. But definitely, it's current knowledge.

Current knowledge is evolving. We learn new things. We have new correlations. Is your best estimate method going to change over time? How do you account for that? I do think you have to account for uncertainties. Maybe not 95/95, but you have to have uncertainties in the definition of a best estimate.

MEMBER PETTI: I have a question for the staff. How was ATWS and station blackout down? It's done on a best estimate basis now because the beyond design basis? Is there anything there that can help in the discussion?

MR. MESSINA: Yes, so we don't have strict guidelines on those. And there is a variety of approaches a lot of times for those types of analysis. Vendors, they prefer to do something maybe a little more conservative than we would accept to make it easier for the review and quick in the review because they don't need all that margin.

MEMBER HARRINGTON: This is Craig. This is a quick question. In the rule package, all the times the best estimate used twice is true best estimate. Was that intended to imply anything different?

MR. MESSINA: It was intended to imply as opposed to Reg Guide 1.157 which says best estimate and uses for 95/95.

MEMBER HARRINGTON: Okay.

DR. SCHULTZ: This is Steve Schultz. Is there a definition then for true best estimate?

MR. MESSINA: I'd say we're relatively open. I think what industry presented today on their understanding of what best estimate today aligns very closely with what we think other than possibly the sampling over the break size -- entire break size range based on frequency.

VICE CHAIR HALNON: I would consider using another one besides true because that leaves the other one as untrue.

(Laughter.)

DR. SCHULTZ: And as you just said, for different applications, the applicant will come in with different definitions of what their best estimate evaluation might be or how they're going to apply conservatisms or no in various aspects of the analysis.

MR. MESSINA: Yeah, exactly. And those would be figured out in the evaluation model reviews and/or LARS.

DR. SCHULTZ: So you would be open to that. We talked about certain ways which the best estimate is defined could be applied in this circumstance.

VICE CHAIR HALNON: Yeah, Joe, I would encourage that if there's some commonalities which everybody agrees on that you would at least provide some guidance from the standpoint of some boundaries. There may be some other areas that you write, some innovative ways may come in or more conservative bounding methods could be used. But it seems like you should be able to package that up and give them some guidance that's somewhat consistent.

MR. MESSINA: Yeah, and that's a good point. And I think through these conversations, we've realized that as part of -- after this rule hopefully goes out, we can have workshops and really fine tune an agreement on this and put it in writing.

CHAIR BALLINGER: We've heard from the industry the word, implementation, almost used as a swear word. But the enemy of that is subjectivity.

MR. MESSINA: That's true. But there's two ways to go. There's regulatory flexibility and regulatory certainty. And we're trying to find the balance here. And we don't want to be overprescriptive and not allow advanced thinking or other methods, but yeah.

CHAIR BALLINGER: Because I'm just wondering if Option A, not Option 1, 2, or 3, or 4, somebody says we're not going to have any burst. And then they come in with that and they argue that we won't have burst based on some analysis that's done which has whatever estimate, not bad estimate, but whatever estimate they use. But if they come in and say, we are going to allow burst and dispersal, then it seems to me the uncertainty of that analysis has got to be much higher, much higher than trying to argue against the burst. Am I reading this wrong?

DR. SCHULTZ: Well, yeah. The uncertainty to analyzing fuel that's dispersed would be very high.

DR. SCHULTZ: Well, this is Steve Schultz again. The other point here -- and this is a more general comment. But we talked a lot this morning about different options that would be allowable and making a case or the treatments here.

And we're talking again about different definitions of best estimate of the evaluation analyses. One of the -- there's two major goals of the overall effort here. One is to maintain safety and alleviate some of the restrictions that are associated with the large break LOCA.

The other is efficiency. And I've become concerned that we allow so many options and so many ways of doing things that the overall process for both the staff as well as the industry will be very efficient in a global sense. But I think the workshops that you just mentioned could -- should be oriented to get by that and make the process more uniform from applicant to applicant and to reviewer to reviewer as well because that's where we got into the analysis paralysis issues when a reviewer might have a different opinion than another reviewer and nothing gets done. And the same thing could be applied when you're talking about the industry applications too. It can become very inefficient if there's not some clear direction as to what will be acceptable.

CHAIR BALLINGER: I thought it was going to take a lot longer. I thought it was going to take a lot longer than this.

MEMBER PALMTAG: I'll just throw out one more thing. When we talk about best estimate and whether you have uncertainty, I doubt that's how the utilities are actually going to do this. So they would always have some sort of bounding calculation that would have some conservatism in it would be my expectation.

You'd have some bounding calculation, some conservatism that can draw a box around everything because you're not going to run a LOCA calculation every time you have a reload analysis. So that may take out some of this uncertainty if you can show you're conservative. So I guess what I'm saying is you can be conservative would be another way of doing it instead of being best estimate.

CHAIR BALLINGER: But the utilities, they're going to use a vendor. And if it's a no burst criteria or whatever they use, they're going to be presented with that rule.

MEMBER PALMTAG: Right.

CHAIR BALLINGER: And they're going to have use that as part of a submittal. So --

MEMBER PALMTAG: I suspect they'd have some bounding calculation. They come up with some bounding calculation. As long as you're underneath that bound, you're okay. You're not going to want to rerun the LOCA calculation for every reload. But that would take away -- if you can show you're conservative, then you won't necessarily meet the uncertainties.

CHAIR BALLINGER: Well, why don't we ask them? They're here. The industry is here. Is there anybody -- a utility -- where's my Duke person? How are you going to do the analysis?

MR. BURKHART: Please speak so you the court reporter can hear you, including you, Chair.

(Laughter.)

CHAIR BALLINGER: I'm singling her out. Guys, you got to know she's the spitting image of my sister.

MS. MATHENY: Hello. How we would do the analysis, I would think that we would be going back to our field support on the analysis.

CHAIR BALLINGER: Okay. So we knew that would happen. But give your name, please.

MS. MATHENY: Well, excuse me. Tara Matheny, Duke Energy.

CHAIR BALLINGER: But what Scott is saying is that you would probably apply some conservatism on it around --

MEMBER PALMTAG: Let the fuels guy come in.

MR. MOUNT: Brian Mount, Dominion Energy, PWROG Analysis Committee Chair. Scott, you asked the question would we keep some margin in the back of our pocket. During the presentation from the industry, I think Kevin Barber gave you a really good answer to this one.

I would not expect a utility to bring forward a LOCA analysis that shows burst in the near future simply because of the uncertainty that you guys have all talked about with the extra analysis and what would that do. So I would not expect a utility. I would think we would go back and try to bring in or maybe not hold back margin or but see what we would do working with the vendor to get to the no rupture case.

MEMBER HARRINGTON: This is Craig Harrington. Is there benefit with that? And I think that's a very logical answer. But is there a benefit to have the opportunity as allowed under this rule? Or would simply having a no burst criteria be kind of --

MR. MOUNT: So there's two answers to that one. For the no burst case, the benefit there would be regulatory certainty with the analysis in the reviews. What would it take, what would we have to give up, what operational restrictions might be placed on our core designs?

That would be the flexibility of allowing burst. We might come up with our reduction factors on the high burnup fuel that would prohibit or remove the benefit and require us to larger batch sizes that the higher enrichment in burnup would then become negated. So having that burst feature could allow some utilities that might be constrained by burst additional flexibility. But there is then the additional regulatory uncertainty. And I think, Lisa, you want to add to that.

MS. GERKEN: I want to add -- my name is Lisa Gerken and I work for Framatome. So my concern with all of this discussion is that we're talking about cladding burst because that's easy and we don't want to deal with something. But we're talking about a phenomena that happens in a LOCA event.

The LOCA rule is for ECS performance, right? So we shouldn't go in and set limits that are prescribing. We don't want this phenomena to happen because we don't want to deal with it or because we don't know.

You look back at the original 50.46 regulation. You're looking at core melt. We said, oh, well, wait a minute. We have this phenomena that 2,200 -- or we have this phenomena where you get the increased metal water reaction.

And we don't know. So what are we going to do? We're going to set limits at 2,200. But that gets lost, right? Fifty years later, I'm here and people are, like, I don't know what 2,200 is.

So I don't think we should be writing regulation that precludes phenomena while uncertainty with the actual value of what particular uncertainty is might be large. You can still do something with 2 sigma. It's just that it may be really, really big because of that point in time you don't have enough knowledge to reduce that uncertainty.

And I don't think we should prescribe a way the phenomena that can happen in LOCA because, like, we mentioned relocation. Well, we already have relocation. It's not in the regulation that we cannot have relocation.

You won't find it anywhere. It's not in Appendix K. It's not in Reg Guide 1.157. But the vendors have been able to come up with methodologies and give them to the NRC.

And the NRC has said, yes, these are acceptable within the framework of our expectation for methodology. So I don't think we should sit down and say, we don't know. We haven't heard about it. It might be crazy. There's a lot of really good work going on right now to understand this stuff better. And we hate to put out something to prescriptive in the regulation about transient phenomena.

MR. KOBELAK: Can I interject as well? Jeff Kobelak, Westinghouse. Bob, I wanted to speak maybe to what you outlined earlier. I think there's a perception that the relaxation in the single failure assumption of boundary conditions could be this really big benefit.

That was something that was permissible largely under the prior 50.46a rule and didn't really get the benefits that we need. There is a time tied up in the models, in the biases, and the uncertainty associated with the physics. That is really where there's a lot of margin tied up.

And then we know there's even conservatism beyond. that when we compare our predictions, excuse me, to integral effects data. And we do statistical analysis, even our nominal cases well overpredict the experimental data. So I do want to just emphasize that I think just looking at the single failure assumption, the boundary conditions for the accident is really not enough to be a success path because of the large amount of margin that's ties up inherent into the EMs when we need to consider all the biases of uncertainty.

MEMBER PALMTAG: So noted.

MR. MOUNT: Brian Mount again. The reason why I started my initial response in the near term is because of that uncertainty. And as the research progresses, the ability to analyze dispersal I would expect to become better.

That's why the current framework that is laid out where there's the option you can analyze burst. But I think it's something that'd be in the future. I don't think you would see near term submittals coming in with that. So I like the flexibility of the burst. But I just wouldn't expect somebody to try to use immediately.

MEMBER HARRINGTON: That's what I would expect. That's the kind of input I was looking for. I believe that's consistent with what the staff is saying. And what I heard was we'll allow burst. It's up to you to show. So if the bidders come and say, well, we want to do no burst, then that will certainly simplify things. But it takes the margin away.

MEMBER ROBERTS: Ron, in terms of your letter being -- having practical responses, I'm thinking something along the lines of we would prefer no burst because of the simplicity. Therefore, we would recommend that the work on the true best estimate LOCA would be prioritized during the rulemaking period with the workshops being planned. And we're trying to get better understanding of what kind of description might be acceptable and what the result would be.

(Simultaneous speaking.)

CHAIR BALLINGER: I mean, that's -- yeah, I think you can come in with no burst if you want to and show us how it works and you don't have to. You can offer dispersal. But you've got to show us that as well.

MEMBER ROBERTS: I think our recommendation would be to try to settle the question and get some sample results relatively early in the rulemaking period to help inform --

CHAIR BALLINGER: Sample results.

MEMBER ROBERTS: Yeah, with the like Jeff Kobelak analysis, Framatome, what do they produce with a true best estimate? To see if there's a pathway to no burst as a criterion or whether the flexibility will need to be there.

CHAIR BALLINGER: And again, that --

MEMBER ROBERTS: That would trigger more research to understand the --

CHAIR BALLINGER: But that would be up to the submitter. That's up to the applicant. They can do no burst or not. And that may spurn more additional research on dispersal and probably would depend on the benefit or what you're forced into doing. But you're right.

MEMBER ROBERTS: Yeah, I think in terms of a recommendation in the letter --

CHAIR BALLINGER: No, you're right.

MEMBER ROBERTS: -- it would actually prioritize this work so we could have this more fulsome discussion.

CHAIR BALLINGER: Prioritize the best estimate.

MEMBER ROBERTS: Yes.

CHAIR BALLINGER: The best estimate estimate. The best estimate definition --

(Simultaneous speaking.)

CHAIR BALLINGER: -- estimate definition.

MEMBER ROBERTS: To better understand what kind of results we would get.

CHAIR BALLINGER: That argues for the workshops this will work itself out.

MEMBER PETTI: That's exactly how I had in my notes just listening to the discussion, Tom.

CHAIR BALLINGER: All right. Have we gotten enough on the FFRD issue to go forward, I hope?

MEMBER PETTI: Well, there was this comment on core degradation.

CHAIR BALLINGER: Yeah, did that come as a result of the very last presentation in the subcommittee where there was -- and I keep saying I'm going to go look it up but I don't do it. Where the person who made the presentation pointed out the fact that there is not a lack of consistency between various analysis that need to be done regarding fuel failure or burst as part of the analysis. Is that what I'm remembering?

MEMBER PETTI: So what I remember was comments from some members about the existing rules are kind of set up to vent core degradation. And here by allowing it, by allowing FFRD, you've got an inconsistency with core degradation basically and these two different parts of the rule.

CHAIR BALLINGER: Okay. I mean, I thought the issue was their current analysis -- Appendix K analysis allows fuel failure.

MEMBER PETTI: Failure, yes. I guess this is this definitional issue. Degradation versus failure, that's where it may just be coming up with a different word or something to help.

MR. MESSINA: So I'm not -- Joe Messina from NuScale. I'm not entirely sure -- if you're referring to rule language. But in the rule language, we say, cladding degradation phenomena. We don't say core degradation.

MEMBER KIRCHNER: I think -- this is Walt. Historically, the idea of the criteria was that the core would remain largely intact. So Joe, when you -- with the rule language, you've got cladding degradation and then coolability.

I'm sorry I don't have the rule language in front of me so I can double check. But how are you going to define coolability if indeed you were to have any significant dispersion. Is that what you mean by coolability or coolability just of what's left of the core?

MR. MESSINA: Coolability, it could be the significant fuel dispersal. It could be -- yes, they would have to demonstrate coolability. It could be -- it's meant to be pretty broad that you have to show that it's coolable. I don't know to define that better.

MEMBER KIRCHNER: It seems to me that's the big branch point that if you get large scale dispersion and you lose geometry, you're into as we've belabored the point already large uncertainties and lack of experimental data and such to verify an evaluation model and test against and so on. So it becomes complicated. Is it possible to have a threshold in the rule?

So you had a clean sheet of paper. We often talk about that. So you have the existing rule which

I have right in front of me. And basically things remained intact.

It doesn't really talk about FFRD because when this was written, that phenomenon wasn't really known, et cetera. But you got a branch -- you got a major branch point in my estimation. And that's where these alternatives that the industry are talking about come into play.

It may turn out that with some of the ATF fuel even for the large break LOCA, they don't see a burst, so no dispersion. So I don't want to say no problem. But basically the rules that exist are then adequate and they'll demonstrate that they can meet 50.46a and Appendix K.

Once you go beyond the -- once you start dispersing fuel, once the geometry is no longer intact, things get a lot more complicated. This seems to be then allowing the applicants to -- and the staff in the reg guide we heard about today, the draft reg guide provides one way to put a cap if you will on the size of the break that you analyze. And that's risk informed.

So it seems to me that the rule structure might be that first assume that these advanced ATF fuel that the fuel manufacturers and the design, it survives. It's good. It meets the criteria. No problem.

You don't even -- the fact that you have increased enrichment and burnup, it can accommodate it. If you get to burst, if you get to significant deformation and dispersal and uncertainty, then it seems to me that's the branch point where you then invoke these alternate -- whether it's Option 2 or Option 4 that we heard about this afternoon. And then you, the staff, lay out in guidance one acceptable way of demonstrating that which you pretty much have done and opened the door also to the industry alternatives.

That's rather simplistic on my part. But it seems to me we're trying to tailor a rule assuming that we can't meet the existing criteria currently if we go to high burnup with the existing fuel design and a large break LOCA. So we're trying to tailor the rule.

It's kind of backwards in my mind. Set out some criteria objectives, whether they're functional or there's prescriptive limits or both. And then if you can't meet that, then say, okay, this is an alternative way that's acceptable to the staff to demonstrate that the probability of risk informed approach of such a great size that would lead to a clad burst and dispersion is not likely. And then invoke those risk metrics to define what the cutoff is.

CHAIR BALLINGER: Do I recall reading a rule or the preamble that doing what Walt is suggesting is allowed? In other words, you can pick and choose. You can use parts of 46 and then take a pick a piece, use part of 50.46a.

MR. MESSINA: Well, I would say yes. You could use 50.46 and use the fuel performance based criteria of 50.46a.

CHAIR BALLINGER: Yeah.

MR. MESSINA: But in 50.46a, yes, there are those fuel performance criteria, performance based. We need to envision that could allow the branches, like you said, different ways to possibly address some of these phenomena.

MEMBER KIRCHNER: I'm thinking assume success that the applicants are going to look at this as someone just said. Probably not going to come forward with an analysis that shows significant burst and dispersion. There may be a penalty involved.

But we've invested all the -- or not we, but the DOE and the industry has invested a lot of money in ATF. I mean, I'm presuming that they're going to reap some rewards from that in terms of cladding performance that will benefit increased burnup. And if there's a problem because the large break LOCA results in burst under nominal evaluation model assessment parameters, then allow the applicant to use a risk informed basis for demonstrating that that large break LOCA can't happen or is highly unlikely -- let me put it in those terms in probability space -- and go from there as a general structural approach and not get caught up Option 2 versus Option 4.

You've laid out a credible path if one were to pursue the -- what's outlined in BG -- let me get the number right, 1426, right? Twenty-eight, sorry, 1428. And it seems there's a fair amount of overlap for you and the industry to look at in your workshops because you do have the LBB as a prominent part of that draft reg guide.

I think what I'm hearing from the industry presentation today is they would want to stop with the LBB and not have all the follow-on analyses that are required. But it seems to me that and likewise with regard to inspections there's some room there for negotiating and coming up with a plausible approach to both the inspection question as well as the analyses. That would allow you to bring in the risk informed approach to capping the size of the break.

MEMBER HARRINGTON: Walt, this is Craig. That would seem like, the approach you're outlining, would tackle increased enrichment and some of those key aspects. But it would not allow for the broader range of possible licensing basis, design basis, and plant operational changes that could come from the 50.46a rule as proposed which is --

(Simultaneous speaking.)

MEMBER KIRCHNER: Well, I don't think it would preclude it, Craig. I didn't mean it in that sense anyway, certainly. I was just trying to address the immediate problem I had which is 50.46a is mainly ECCS performance and core coolability, et cetera. Yes, there are other ramifications to be explored.

CHAIR BALLINGER: More discussion? Are we satisfied? Well, maybe we're not satisfied for today. Are we at a point where we have to move on? Okay. I would suggest that the next topic is clad testing which might just -- might be as contentious as well.

So I recall that in our original 50.46c discussion one of the -- and we wrote a letter to that which is somewhere in the hole where we questioned -- we did question the amount of testing that would be required to satisfy 46c at that time. And I thought that the revised DG that came from the DG 50.46c did allow more flexibility in testing. But I didn't have a chance to go back and read it. But I didn't get the impression from one of the presenters -- industry presenters that was the case. So maybe we can hear from -- I think it was --

MR. MESSINA: James Corson is online.

CHAIR BALLINGER: Okay.

MR. MESSINA: He's the --

(Simultaneous speaking.)

CHAIR BALLINGER: That was a big problem. We actually went and visited -- I think we visited Westinghouse. And they had a set up going on there. They were going to do testing of individual cladding batches and the like.

And I thought that the new -- the revised DG would allow more generic testing that wouldn't require more specific testing going forward because of the quality -- because of the stuff that they mentioned, quality control, the way we did it. And anyway, that's the impression I got. But I don't know. I probably was wrong.

MEMBER PETTI: Ron, the concern that I had was that this is a set of requirements that's a little bit outside the fuel vendor's typical day-to-day stuff that they do. And it would be better if you could come up with other surrogate metrics that you could use to say this clad is good.

CHAIR BALLINGER: And that's what I meant by the quality control and manufacturing --

MEMBER PETTI: Right, right. I mean --

CHAIR BALLINGER: -- process that sort of brackets everything and guarantees that you don't -- the cladding performs appropriately.

MEMBER PETTI: Right. I mean, with these advanced clads, we've had hundreds and hundreds of batches I'm assuming. And so there's good data on what the impurities are. There's good data on some of the other fabrication stuff.

And collectively, I mean, that probably tells a pretty good consistency story. And couldn't that be used to say there's low risk that you're going to get this type of oxidation that occurred with the Russian cladding. And yet I didn't see that sort of flexibility in the guidance.

MR. BARBER: Yeah, this is Kevin Barber from Westinghouse. I think what you just mentioned is exactly what we were hoping for. I think that the bullets to be put in the industry presentation slide we're trying to highlight those exact points.

And as Joe Messina mentioned, James Corson is on. And he certainly did speak to the fact that it's a draft reg guide and industry could take other alternatives to make this argument that really has just been discussing. I think that we just think they'd be more efficient to bypass that given all the quality control that we have and the manufacturing process. And we've talked about this with Framatome. I think it's a united front from all three vendors.

(Simultaneous speaking.)

CHAIR BALLINGER: I'm sure we had that discussion in our earlier letter about this topic about the issue of quality control and being able to guarantee performance based on --

(Simultaneous speaking.)

MR. BURKHART: Chair, the court reporter can't get you if you're --

CHAIR BALLINGER: Oh, I'm sorry. But I think in our 50.46c letter, the earlier one, we did have a discussion in there about using consistent manufacturing process, all the quality issues and everything to argue that the cladding will perform without this breakaway, if you want to call it, oxidation. And I think we were hamstrung by that figure of E110.

I can guarantee you that you don't get that kind of breakaway oxidation. You just get a knee in the curve where it goes from parabolic to linear. And it's not one of these catastrophic things that occur.

MR. CSONTOS: So this is Al Csontos, NEI. The letter that I mentioned is one of the ML numbers, I think you got them or got one of them. The last bullet, the March 2023 letter, talks about this breakaway testing.

And we recommend it be removed due to these exact same points you're mentioning here. And if you need more information on that, then we can provide it. But we believe it's --

(Simultaneous speaking.)

CHAIR BALLINGER: For ATF fuel, if you've coated cladding, where's the breakaway oxidation?

MR. CSONTOS: And that's where --

(Simultaneous speaking.)

MR. CSONTOS: That's where there's a lot of new -- the newer alloys also take advantage of different additions for the fuel to be less -- to have less oxidation. So there's a lot of things that we talked about in the letter that talked about how the manufacturing and the fabrication, especially the newer alloys really are resistant to this. And if you take a look at that last session, it talks about the fuel and not just ATF fuel but new fuels.

CHAIR BALLINGER: Yeah, I mean, again, I'm sure we've had this discussion with the original 46c letter.

MEMBER PETTI: But I think -- I mean, I think it's worth including here, Ron, because in December we talked about it a lot. And now we're hearing industry still thinks it's an issue. So I think it's worth keeping in our letter that we think --

CHAIR BALLINGER: Oh, yeah.

MEMBER PETTI: -- more flexible guidance is needed.

CHAIR BALLINGER: Okay, good.

MEMBER PETTI: We're making progress.

CHAIR BALLINGER: Don't you hate it when that happens.

MR. WANG: James Corson has his hand up.

CHAIR BALLINGER: Oh, we have a hand up. James?

MR. CORSON: Yes, this is James Corson from the staff. And I would just like to say that originally early in the 50.46c process there was a pretty inflexible of the draft guide that required a lot more testing. What ended up being submitted with the final package as a little bit more flexible.

The idea was that you would have some vendor plan or vendors would come up with their own plan where they could make perhaps the sort of arguments that you say about manufacturing processes and so on that would dictate what they would need to do going forward, like, additional testing or what have you. So that's what's in the current guide. It's more flexible than the very early days of 50.46c.

But certainly, I understand your point. It would be good perhaps to be a little more clear about expectations there. That's something we'll think about.

CHAIR BALLINGER: Yeah, I think that softening of the original 50.46c rule was probably resulting in some part from our letter. Okay. Other comments, discussion on clad testing? Did Paul Clifford leave? Hiding out back there or what. You're the culprit. Okay. Let's move on to 1.183. And I think control room dose are probably packaged.

MEMBER PETTI: Yeah, but my first comment on 1.183 is not.

CHAIR BALLINGER: Oh, okay. All right.

MEMBER PETTI: It's something that industry has talked about twice. And it wasn't really discussed in the December meeting. Someone has to explain to me what this DBA LOCA with an AOO dose limit of what, six and a quarter rem, when everything that we think about, LOCA now is beyond -- largely goes beyond design basis.

So I'm just confused. So I'd like to see if 1.183 authors could enlighten me a little bit about that. It's in the table, but I must've -- we had so much to read.

I must've just skimmed over it when I was reading that reg guide since I've done it four or five times it seems. Could you tell me what's going on there? What do you mean by that?

MR. DICKSON: This is Elijah Dickson with the staff. For the 1.183 working group and writing this Version 2 of the guide, DG 1425, the development of the language in regards to handling the radiological consequences of FFRD stem from Alternative 4 in the regulatory bases. And the dose acceptance criteria that we included in -- I believe it's Table 7 in DG 1425 stuck with the well within dose acceptance criteria for other DBAs that also can result in fuel damage.

So for the non-LOCA DBAs that we look at, we do assess them from a radiological consequence perspective. And effectively was limiting the amount of cladding damage for these other non-LOCA DBAs. You can think of, like, control rod injection, power excursion type of events. It's that consequence analysis -- dose based consequence analysis. So it's not AOOs. It's within DBAs.

MEMBER KIRCHNER: Seems to be -- this is Walt Kirchner -- just an arbitrary one-fourth of the 25 rem criteria for siting based on MHA and the design containment leakage. So why one quarter of that 25 rem?

MR. DICKSON: We're effectively just being consistent with the other non-LOCA DBAs that we've assessed with the well within criteria 6.3 rem. So all those other non-LOCA -- well, except for some of the ones that you might be in an LCO that have a 25 rem. We simply put the 6.3 rem there.

MEMBER PETTI: But I guess I'm still struggling. You are talking about a large break LOCA DBA. Isn't that a contradiction in terms now? A large break LOCA is a BDBA.

(Simultaneous speaking.)

MEMBER PETTI: Do you mean some smaller LOCA?

MR. DICKSON: It's effectively the 50.46 analysis. Large break LOCA would have this dose acceptance criteria 6.3. We needed to put something out there, and the rationale was stick with what we've been doing now for 40 some odd years and putting some type of acceptance criteria there with the 6.3. And we kicked around half, maybe 12.5. But we stuck with 6.3, limiting the amount of -- well, making even, I suppose, the -- from a consequence analysis perspective similar to the other DBAs that we assess.

DR. SCHULTZ: Elijah, this is Steve Schultz. Isn't this the event, the case where you haven't been able to demonstrate that you don't have a large break LOCA? You haven't used the opportunity to claim that there is no break.

MR. DICKSON: That's right, yeah.

DR. SCHULTZ: And therefore, you got -- you're still doing the standard LOCA evaluation. Only in this case, you also have to take into account the dispersal --

MR. DICKSON: That's right.

DR. SCHULTZ: -- of the relocated material.

MR. DICKSON: From a consequence analysis point of view, it's very similar to -- so in the standard review plan, we have 1565 that is the LOCA resulting from special postulated breaks. Within the standard review plan for these analyses, it does kick you off into doing consequence analyses if you can do breach fuel. So it's effectively patterned off of that line of thinking.

MEMBER PETTI: But this would only be in the event that it's -- so I'm going to ask this differently. Before this rulemaking, there was a line in the table called DBA LOCA and had to meet 6.25 rem. Is that true?

MR. DICKSON: Yeah, before this, there was no DBA LOCA dose acceptance criteria.

(Simultaneous speaking.)

MR. DICKSON: Now we have the MHA LOCA dose acceptance criteria. We talk extensively about that, last month and for all of the other source term presentations that were given to us. The intent of having this dose acceptance criteria for a 50.46 analysis that does predict fuel damage, you would then be kicked off into doing the dose analysis. The acceptance criteria that we decided to put into the Regulatory Guide for one of these types of analyses is 6.3 rem.

MEMBER PETTI: Yeah, I'm still struggling with -- okay, now I understand what you did. It's a

DBA LOCA that has fuel damage. So you have a source term.

MR. DICKSON: Right.

MEMBER PETTI: And you meet the criteria. But if it's a large break, isn't that a beyond design basis event? I could see, like, a medium LOCA or something. Maybe this -- are you trying to cover the case of some sort of a LOCA right around the TBS where you could get damage?

MR. DICKSON: It's separate from the TBS. So the standard review plan, again, 1565, has one go and do the spectrum of accident LOCA analyses. And you have to meet the 50.46 acceptance criteria. And if you do predict fuel failure in that analysis, this is your traditional 50.46 analyses, you then go do a consequence analysis.

The consequence analysis has the acceptance criteria of in this case 6.3 rem for, like, the other non-LOCAs to such as control rod ejection. What limits the amount of damage to that fuel is eventually limited when you go do the consequence analysis. So let's say, for instance, a control rod ejection accident.

The performer calculations and if the -- just recently for one of the ASTs that I've done pretty recently for that particular PWR. They assumed anything over a certain burnup limit with 62 gigawatt days per MTU failed. For that particular DBA, it's not an AOO. It's a DBA, design basis accident.

You then use Reg Guide 1.183. I think it's Appendix K. And follow the dose analysis there. Calculate your EAB and LPZ does results. And if you're below that acceptance criteria, that amount of fuel damage that would be found acceptable for a DBA. Not for an AOO, but for a DBA. That's the standard practice.

So the thought was under Alternative 4, if we're going to start going down the route of doing 50.46 analyses that do predict some amount of fuel failure, well, Technical Specifications Criterion 2 tell you to go do a consequence analysis. Put in an LCO or borrow information from the COLR report to then go do the dose analysis.

So this is how -- and I didn't really get a chance last month to really describe how this all works under this Alternative 4. We ran out of time. But I can go through a bit of that. I guess I'm trying to do that now without a set of slides which is -- and at the end of the day too, by the way. I don't feel like I'm being terribly effective. But going to the SRP 1565 really does describe how you go about doing this analysis.

MEMBER PETTI: Okay. So it's really only in the event that you do burst. All the stuff we talked about with no burst, you wouldn't need to do this.

MR. DICKSON: That's right.

MEMBER PETTI: Okay. So my guess is a simple footnote or something that would tie that together would maybe help. But you guys can decide that. Okay. I understand.

MR. DICKSON: It wasn't a longer discussion in the proposed rule language to really hear all this information out so you can read it and understand it as how it's being executed in the regulatory guidance. So I understand.

VICE CHAIR HALNON: This is not the only mechanism that's going to get a source term.

MR. DICKSON: Right, yeah.

MEMBER PETTI: No, I'm okay. That's fine.

MR. DICKSON: Okay.

MEMBER PETTI: Let's move on to control rod dose then.

CHAIR BALLINGER: Do you remember who the author of that comment was?

VICE CHAIR HALNON: Bob, Dave, and Walt.

CHAIR BALLINGER: Oh, you got the --

VICE CHAIR HALNON: And Ron.

CHAIR BALLINGER: -- the extended version.

VICE CHAIR HALNON: Everybody but me.

MEMBER KIRCHNER: Ron, this is Walt. I'll start off. I thought in the preamble of -- and the nice presentations we had in December that those were quite thorough. I thought there was ample justification for the 10 rem and up to 25 rem not as a special assignment but under emergency and accident conditions, et cetera, et cetera.

I won't repeat the preamble. But given that, I thought that was sufficient justification. I just personally felt the table of graded level of doses allowed versus a CDF calculation. I get it, but I mean, it should be a LERF calculation, not a CDF calculation.

But I think for the purposes at hand, that is just not necessary and raises a lot of questions that would draw I think the wrong kind of attention to what the staff is trying to do here with the rule. I think the 10 and 25 under accident conditions is defensible, justifiable, and let it go at that. But having a sliding scale based on CDF calculations, I don't think that's the best use of risk informed results from PRAs.

MEMBER ROBERTS: Yeah, I think I agree exactly with that. I mean, why do you need that if you meet the criteria by the sliding scale? When you say 25 under accident conditions, are you referring to severe accidents or hypothetical accident? Because I assume the difference in terms of whether or not containment is assumed to be intact as a deterministic assumption or whether you allow the progression of the accident to determine whether or not containment is intact. So I wasn't sure when you said accident whether you meant MHA with the containment intact assumption or --

MEMBER KIRCHNER: Well, from my standpoint, I know this is not being very rigorous. But if we've got that kind of dose coming out of the containment, whether it's a severe accident or not, no, I was just thinking in terms of a major hypothetical accident. You got the containment leak rate and you've got an exposure.

So there you have it. Then with 1.183, you have a modification to the older TID dose. Again, you're looking at a severe accident and get these kinds of doses.

MEMBER ROBERTS: I wasn't sure what your

construct was of the 10 versus 25. The 10 rem already assumes that you're at accident. So what were you saying the 25 would apply to?

MEMBER KIRCHNER: No, 10 as a design limit for the control room and 25 under accident conditions.

CHAIR BALLINGER: That's what I thought it is.

(Simultaneous speaking.)

MEMBER KIRCHNER: GDC-19 is 5.

MEMBER ROBERTS: It's 5. The proposal was 10, but that's for accident conditions. So the 10 applies to accident conditions, and the 15 through 25 apply based on the underlying CDF that the licensee calculates. So again just Walt, when I read your proposal, I wasn't quite sure how you would get from 10 to 25 because the 10 already assumes an accident.

CHAIR BALLINGER: But the 10 assumes -- I don't know.

MEMBER KIRCHNER: No, 10 is a limit.

CHAIR BALLINGER: Yeah, 25 is for special case.

MEMBER ROBERTS: Right. That's the emergency response and not in the draft rule. The draft rule would have 10 to 25 all apply to accident conditions. So again, I just want to be clear what the criteria was again from 10 to 25 and was in CDF or LERF.

MEMBER PALMTAG: Isn't that the design of the control room that we have?

MR. DICKSON: That's right.

MEMBER PALMTAG: That was my concern with the control rod dose is the way it was written with the CFDs is it would take the current fleet up to 25. That seemed like a large jump to me, go from 5 all the way up to 25, a factor of 5 of the maximum dose. I'd be more in favor of a maximum dose of 10 on an accident scenario.

MR. DICKSON: So what we did in this rulemaking is we went and reassessed the bases for this rule that goes all the way back to 1972. Looked at what could be possible in regards to design criteria given today's understanding of radiation protection and EP. And we didn't want to approach the -- knowing that there's a range, right, we didn't want to approach the rulemaking to say, well, we can give you a factor of 2 and just stick with 10 because then that would lead us to a bit of criticism.

Well, you have other acceptance criteria that go up to 25. Why can't you have 25 for the control room? So we are trying to provide some flexibility.

And what really drove us down this route of trying to leverage some PRA information to provide some flexibility. You have very, very low CDF numbers to go up to 25. Was this SRM-SECY-98-144 that I discussed continuously during those two days that asks us to do performance-based and risk informed regulations? And this was an attempt to do that. So to bridge this range of 10 to 25 rem, that's what you came up with.

MEMBER KIRCHNER: There's no justification for exposing people to more radiation just based on a CDF calculation. I mean, decide what limit you can withstand under normal design conditions and then under accident conditions. Once the accident happens, you're not in a situation where you say, oh, we can only go to 15 rem now. I don't see the logic. That's --

MR. DICKSON: Again, this is --

MEMBER KIRCHNER: -- my problem.

MR. DICKSON: -- our design criteria under Part 20. We are not messing around with the actual occupational exposure limits under Part 20. This is specifically design criteria in trying to provide some additional flexibility here.

When you get into these beyond design events, very severe accident events, this goes back large uncertainties under severe accident conditions. You may not have the control room as designed operating under those types of conditions. And Fukushima was an excellent example of that in which they had an ELAP event, extended loss of offsite power.

It did not have onsite power, onsite emergency power. Nothing in those control rooms were operating, period, that would be protecting the individuals other than the intrinsic concrete that was built around the control room to protect against the skyshine. It was the RP programs that effectively protected the workers during the actual event, doled out dose to go do mission doses. And they did a very good job of protecting the operators. When we get into this discussion between, like, severe accident and design basis, things start to really do get cloudy and --

(Simultaneous speaking.)

MEMBER KIRCHNER: Oh, I agree with everything you said.

MR. DICKSON: Right.

MEMBER KIRCHNER: That's why I'm saying

don't invoke CDF -- differences in CDF from plant to plant and have a sliding scale. Just say if you're in a severe accident, up to 25. And then as you said, the rad protection program then you're going to move people in and out and do whatever you need to keep the exposures under that level.

MEMBER DIMITRIJEVIC: This is Vesna Dimitrijevic. I have to say I completely agree with Walt's discussion on this. That's absolutely doesn't make any sense.

It looks very artificial. It doesn't have a logical connection. So just that will look risk informed. It doesn't even meet this. Core damage frequency presents the risk to general public.

I mean, we are computing -- there is no -- as I said in my previous discussion, there is not really risk measures here. So I think just keep it simple. We don't know too much about some of those things, dose effect and things like that. So splitting in the four regions does not really make any sense logically.

VICE CHAIR HALNON: I think -- this is Greg -- we're still conflating a design structure and problematic controls. First is occupational dose. You're still going to have to have special exceptions and permission to go to 25 rem if you're going to do that. This is not an allowance for an operator sitting in a control room until he gets 24.99 rem, then he has to go home. This is how you're designing your programs and your structure relative to leakage and other things. So it makes sense to me as a layman to say the safer the plant, the less robust design you need to have.

MEMBER HARRINGTON: This is Craig. That's all we're saying for the plant. But the less likely that kind of an event could occur.

VICE CHAIR HALNON: That's another way -- a better way of putting it.

MEMBER ROBERTS: There's a precedent in NEI 18-04 and it's got the frequency-consequence curve so that the curve that -- and the logic came up with actually parallels pretty well with the curve that's in 18-04 in terms of slope.

MR. DICKSON: It's similar to other graded dose based graded approaches, absolutely.

MEMBER ROBERTS: And it's important to keep in mind here is that the 25 rem, 10 rem, whatever is, is it artifice because the scenario that drives it probably can't happen. It's certainly very unlikely because the scenario has a severe accident release from the core in the containment where the reactions there soon stop immediately before containment damage essentially. And so the containment is not degraded by a severe accident.

The combination of events, it probably cannot happen together. And so if you had a design basis accident, that's kind of the 6.3 we were just discussing a few minutes ago, much smaller source term and a much smaller dose for the control room operator. Consequently, if you had the severe accident, it'll be a lot more than 25 rem probably because you don't have the benefit of containment. So it's really just kind of a figure of merit, and you can make up almost any number you want as long as the control room you get from that number is reasonably leak tight and protects the operators.

MR. DICKSON: There are programs in which we are testing the control rooms and its leak tightness. So when we see a license come in for an AST and they're changing all sorts of different types of design and licensing basis assumptions. And unfiltered in leakage is a prime example of an input parameter in the dose analysis that has margin.

So let's say, for instance, a licensee comes in with their dose analysis and they assume 400 CFM unfiltered in leakage, right? Well, they use that value for -- we call it operational flexibility purposes, right? And so often what we'll see in these license amendments is their control room habitability testing program where they're doing tracer gas tests.

There's a Reg Guide 1.196, I believe, that talks about this and talks about these programs. This program is controlled within technical specifications, administrative controls. And they'll show us the results of these tracer gas tests.

And one recently I looked at, they assume 400 CFM in the control room as an unfiltered leakage. But their tracer gas test results show zero, 11, and 12 or maybe it was 15 CFM. But effectively showing that they do have a leak tight control room.

These are things that we consider and look at for defense in depth purposes when we're doing these types of analyses. So yes, they have a bunch of -- from a design point of view, from a design basis point of view, not so much maybe from a severe accident point of view plenty of margin to these figures of merit, I suppose. Providing additional flexibility from 5 rem to 10 rem doesn't necessarily mean we're going to be providing or resulting in leak in control room. We have programs that if you test these control rooms. And often, it's very, very low values.

MEMBER PALMTAG: I'm still concerned about the amount. I mean, just going from 5 to 25 just seems like a huge jump. I mean, I understand you want some operational margin or flexibility.

But I would think going from 5 to 10 would give the utilities that. Just arbitrarily changing maximum dose by a factor of 5. And the argument wasn't really compelling to me. There's five papers, and they range from 10 to 25. And therefore, we picked 25. I didn't think that was really compelling.

VICE CHAIR HALNON: Are these consistent with the emergency dose?

(Simultaneous speaking.)

MEMBER PALMTAG: You made the distinction between the design and containment or the control room design versus maximum dose that they're actually going to get. It kind of seems like we're double counting it because how you design it should depend on the dose or the accident scenario. If there's a low probability, it should be easier to design. But I don't understand why --

VICE CHAIR HALNON: That's why you go higher.

MEMBER PALMTAG: -- the probability -- right. I don't understand why the probability would correspond to the dose.

VICE CHAIR HALNON: Risk informed is a thought process, not necessarily numerical.

MEMBER PALMTAG: But there's also considerations, Tom and I were talking about, is the control room not just about the dose of the operators too. It's also you need sort of a safe space. You need a way to planning --

VICE CHAIR HALNON: You need accountability.

MEMBER PALMTAG: Yeah, I mean, I think it's something you want the operators to feel safe. Now we're saying, okay, we're going to take the maximum dose and multiply by five kind of arbitrarily.

VICE CHAIR HALNON: In severe accident, design basis accident, and how people feel is not always that important.

(Simultaneous speaking.)

VICE CHAIR HALNON: Yeah, you don't have to come in happy if you're experiencing a DDA.

MEMBER PALMTAG: To design something.

VICE CHAIR HALNON: Not really.

MEMBER PALMTAG: Or you could do planning.

VICE CHAIR HALNON: I get it. I understand.

That's why you have TSCs in the U.S. that are away and have their ventilation system requirements.

CHAIR BALLINGER: I hate to try to cut this off a little bit. But it is 5:00 o'clock, and we do have -- on our agenda, we have to go out for public comments. We have remaining Item No. 8 which unless we plan on staying past whatever to do this, we're probably going to have to leave that till tomorrow.

And I think the only thing we have to do tomorrow plus other discussions related to letters and stuff, I think we're in very good shape actually. So I would propose that we now go out for public comments. And we leave the victims and start back up tomorrow morning on broader impacts.

And that's a very open ended discussion. So I'm not exactly sure who would we would need to have here if we're having an open ended discussion. But I can't say anything more than that.

I don't know what we would have. Staff and the industry have been extremely good about participating and doing presentations and everything. So we really appreciate that.

But that's my proposal. So if that's agreeable. Now we need to go out for public comments. And that would end it. So unless we have other comments by members, that's my plan. So if there are members of the public that would like to make a comment, please state your name. And that, by the way, includes in the room --

MEMBER PALMTAG: Ron, you may want to try that internal and external.

CHAIR BALLINGER: Yeah, yeah. That's what I was going to -- as soon as I realized it was somebody breathing down my neck. So let's go outside first.

VICE CHAIR HALNON: The external folks raise your hand and we'll catch you in sequence. So it's Kalene Walker.

CHAIR BALLINGER: We have one.

VICE CHAIR HALNON: You need to unmute yourself and then state your name and any affiliation you may have and then go ahead and make your comment.

MS. WALKER: Thanks. it's Kalene Walker, public citizen, no affiliation. I just had a couple of quick clarifying questions before comment. When you say burst, no burst versus allowing burst, what exactly are you talking about doing, allowing burst of what? And could you just clarify, high level, what you're talking about here?

CHAIR BALLINGER: Well, I'm afraid that we have to sort of punt that because we are only taking public comments, not questions. If you have a question, we have a vehicle for that. That is please communicate with Weidong Wang on this topic because -- and he will get back to you. And you can have a dialogue that will satisfy you in a setting which is not as rushed as what we're here.

MS. WALKER: Okay. Is that contact in the meeting notice?

CHAIR BALLINGER: Yes, it is.

MS. WALKER: Okay, great. Okay. Well, my comment would be along the lines of when I was hearing the discussion about inspections, you're saying you'll decide what to inspect based on the convenience of access and radiation dose. But what thought came to my mind was, well, what if there's degradation piping or whatever you were inspecting for. If that's in a really hard place with a high dosage, does the NRC require that there be a mitigation plan, a doable plan and in response to some kind of aging process or degradation?

And I was wondering I guess it sounds like you're allowing increased enrichment for existing reactors. So we're talking about older reactors. The increased enrichment is obviously to allow higher burnup.

And this NUREG whatever it was recently said that burnup might go up as high as 80 in these older reactors. And this is purely for economic reasons that that's being done. But I don't think the safety case is complete.

And regarding FFRD, the bottom line, everything you do leads to spent fuel management. And so if you have FFRD on any kind of level that's been released, I've asked this numerous times at numerous of these meetings. How the heck are you going to store that fuel if you pulverize fuel pellets with a large break in the cladding?

And the final comment is that a NUREG -- no, an ISG or ATF ISG that came out, they outlined a lot of problems with these new fuels. And they had not been proven within this latest ATF ISG. So relying on this ATF fuel to be able to withstand one of these LOCA incidences is not necessarily a viable path forward if you're concerned about public safety. I guess that'll do it for the moment. Thank you.

CHAIR BALLINGER: Thank you. I'll restate. Please communicate with Mr. Weidong Wang and he can have a dialogue with you. It'll be much more complete. I don't see any other hands up at least.

But even if your hand is not up, if you're a member of the public and you'd like to make a statement, please unmute yourself, I guess. And then give us your name and your organization, if you will, if you want to, and make your statement. Okay. Thank you.

MR. LYMAN: Hi, this is, sorry, Edwin Lyman from UCS.

CHAIR BALLINGER: Yes, Ed.

MR. LYMAN: Yes, sir. Can you hear me? I'm on the phone today.

CHAIR BALLINGER: Yes.

MR. LYMAN: Okay. I guess one comment I'd like to make is that when you talk about risk informing, I think there needs to be more careful examination of the holistic application of risk informing everything to make sure that you don't end up with circular reasoning. I'll point out one example. When NEI raised the issue of the post-Fukushima seismic hazard reevaluations have all been resolved and why don't they get credit for that. What do they have to do?

Why is the draft reg guide saying they have to do further seismic analyses? And in this case, look at what the resolution of the post-Fukushima reevaluated hazards actually were. I'm not aware that a single plant was actually required to make any modifications even though quite a few of them ended up with a reevaluated hazard curve that exceeded their design basis -- their GMRS of record in various frequency domains.

And in each case, this was resolved by essentially saying it wasn't risk significant or wouldn't need a backfit test. So there were no actual changes made. So then if you take credit for that and then to exclude -- to come up with a transition break size, something like that, then you might be engaged in circular reasoning because the analyses that were done to the extent there were any seismic PRA, for example, did not take into account the potential for the additional phenomena that you're concerned about here.

So I think it's really important that risk informing does not double count it in a way that would end up leading to some consequences that are outside of the risk spectrum that was evaluated. Another example is sabotage. And I know that's outside of the committee's domain to a large extent.

But that is another way in which the large break LOCA could occur. And the NRC is giving credit now to security programs for what's called the security bounding time. That may require analyses of the time to core damage so that some damage to SSCs is allowed provided that there can be mitigation.

And I haven't thought through the implications of that. But is there potentially some circular reasoning going on there as well would change to the -- let's say the large break LOCA analyses have an impact on that time to core damage which may impact whether or not it was appropriate to give credit to security. So it can get very complicated, I think.

And I just want to -- I'm sure there are more examples of this. And I just wanted to point out those two. So thank you for listening.

CHAIR BALLINGER: Thank you. Okay. Since I missed one, there may be others. So if there's anybody else out there, excuse me, that would like to make a comment, please identify yourself and make your comment. I'm doing better this time. I can feel the heat on the back of my neck.

MR. CSONTOS: Al Csontos, NEI. Just wanted to say thank you. Just wanted to say thank you for the opportunity to present today and provide our feedback. We do have a couple of comments to answer I think some of the questions that were raised and get a better answer for you. So I wanted to go ahead and open the door for those answers.

MS. MATHENY: Tara Matheny, Duke Energy. So first comment relating to your question that you had earlier when we were talking about schedule impacts. So I think the discussion that we had was really good, talking about the impact in the nuclear fleet and how a schedule push could impact multiple sites.

But we didn't talk holistically about for our power companies what that looks like in their planning. So a lot of planning is going into increased demand for customers and things like that. And so incorporating all of that into holistically not just for the nuclear fleet but schedule impacts impact our plans to be able -- to get power reliably to our customers. So I wanted to make sure we highlighted that as well.

And then also a second comment, we would like to -- Duke would like to verbalize our support for ALS, particularly for the staff to continue their review of ALS and how ALS could risk inform FFRD and fit into the framework of the draft guide that we have and the rulemaking that we have and make it help with implementation. I wanted to verbalize that. Thank you.

VICE CHAIR HALNON: Thank you.

MR. STAVELY: Jim Stavely, PSEG Nuclear. Just two things. I'd also like to reinforce the importance we put at PSEG ALS. It's a path forward that has a solid timeline to allow us to move with our plants. So I appreciate again as Tara said with the reviews being performed by the staff.

Also, I'm lucky enough -- honored enough to be the technical chair for the EPRI Fuel Reliability Program Research Integration Committee. So in terms of the importance that -- I'm not quite speaking for EPRI but kind of like speaking for the committee is there's a lot of emphasis and value placed behind ALS. I think you've heard over the last number of months the amount of effort we've done to try to support not only the generation of the submittal itself but also the additional documents that lay behind the submittal.

So it is very important to the PWRs. And we again encourage from that aspect for the Research Integration Committee of the importance and the continuing review of that submittal. So thank you.

MR. LI: Guangjun Li from GEH. Yeah, just want to echo was Lisa just discussed. FFRD is phenomena. So we don't want to try to limit phenomena. It happens. And I think the rule should be flexible enough to know this is working for one type of the plant or one plant. But it should have a way actually for everybody to use.

You cannot open the door for one plant and close the door for others. That's just something basically especially BWR. I think we have to realize BWR is different from PWR.

And PWR, yes, there's something like a leak before break and ALS, all of this. And for BWR, it's really hard to do. And I think the rule should be flexible enough basically, just the criteria for if you have dispersion. What should you do?

Basically, what we really care here, it's consequences. So it's probability, loss long term cooling. And you have the threat (phonetic) case, of course. Eventually, you have the dose.

So that's why I would have this NEI letter, 2023. Basically, it's a modified Alternative 4. So basically, so the alternate offer. So that's basically -- that's my comment. Thank you.

CHAIR BALLINGER: Thank you.

VICE CHAIR HALNON: Anyone else need to get something off their chest?

(Laughter.)

VICE CHAIR HALNON: I think you wore them out, Ron.

CHAIR BALLINGER: I think we're -- yeah, that's probably a good way to put it. So unless there are other comments from members --

MEMBER PETTI: Ron?

CHAIR BALLINGER: Yeah?

MEMBER PETTI: I didn't want you to close the meeting. I think we should talk about I don't necessarily think industry needs to be here tomorrow unless they want to. And I think even the staff could participate remotely.

CHAIR BALLINGER: Yeah, I was -- we were going to have that discussion, yeah.

MEMBER PETTI: Okay. Oh, good. Okay.

CHAIR BALLINGER: Yeah, and I guess I'm not sure who to address this to.

PARTICIPANT: I'll be here in person no matter what.

CHAIR BALLINGER: You'll be here no matter what. Okay. I mean, the idea of industry doesn't have to be here unless they want to, of course. The same thing goes for the staff.

It would be nice if there was a sort of conduit that we would have if we had a question or some discussion that came up where we needed to get -- where a staff member's comment would be more than would be appropriate. So that would be my request. And so unless I -- well, maybe I should talk to Theresa.

MS. CLARK: Yes, we plan to have our team available tomorrow.

CHAIR BALLINGER: Okay. That's wonderful.

MS. CLARK: And I think most of them will be here because they planned to be here.

CHAIR BALLINGER: Yeah.

MS. CLARK: And we'll take it as long as it takes.

CHAIR BALLINGER: Wonderful. Okay. That solves that problem.

MR. BURKHART: Yeah, this is Larry Burkhart. Just -- and I'll let Al Csontos weigh in from the ACRS staff. We did have a discussion with Al Csontos who has coordinated the industry and EPRI's presentations.

And Al, I'll let you speak. But the discussion we had is that he would be available and he would make sure he has the contacts available in case they are needed. So Al, why don't I turn it over to you.

MR. CSONTOS: Yes, Al Csontos, NEI. Yes, so

I'll be here tomorrow. Frankie (phonetic) will be here tomorrow. And we'll have some of the industry here tomorrow to answer. And I will be able to then have a conduit to go back to the team to ask any questions or to get your response. So we'll be here to support it.

VICE CHAIR HALNON: Thanks, Al. And one of the things that I'm going ask tomorrow is if I come into the control room the day after a limitation as an operator. When am I going to see different? When am I going to do differently? So you can -- over dinner and whatever beer you have --

(Laughter.)

VICE CHAIR HALNON: -- discuss that and come back with some juicy stuff. I was talking industry speak.

CHAIR BALLINGER: Okay. So with that, again, I'm sure I speak with the subcommittee that we appreciate the effort that's been made and getting our questions answered. And we'll pick this up tomorrow morning at, I guess, 8:30. And so with that, we are -- I think it's going to be recessed until tomorrow morning.

(Whereupon, the above-entitled matter went off the record at 5:20 p.m.)

Official Transcript of Proceedings

NUCLEAR REGULATORY COMMISSION

Title:	Advisory Committee on Reactor Safeguard Regulatory Rulemaking, Policies and Practices
Docket Number:	(n/a)
Location:	teleconference
Date:	Friday, January 17, 2025

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NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

+ + + + +

REGULATORY RULEMAKING, POLICIES AND PRACTICES

SUBCOMMITTEE

+ + + + +

FRIDAY

JANUARY 17, 2025

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The Subcommittee met via Videoconference, at 8:30 a.m. EST, Ronald Ballinger, Chairman, presiding.

SUBCOMMITTEE MEMBERS:

RONALD G. BALLINGER, Chairman

GREGORY H. HALNON, Vice Chairman

VICKI M. BIER, Member

VESNA B. DIMITRIJEVIC, Member

CRAIG D. HARRINGTON, Member

WALTER L. KIRCHNER, Member

ROBERT P. MARTIN, Member

SCOTT P. PALMTAG, Member

DAVID A. PETTI, Member

THOMAS E. ROBERTS, Member

ACRS CONSULTANTS:
DENNIS BLEY
STEVEN SCHULTZ

DESIGNATED FEDERAL OFFICIAL:
WEIDONG WANG

ALSO PRESENT:
LARRY BURKHART, ACRS/TSB
THERESA CLARK, NRR/DSS
AL CSONTOS, NEI
ELIJAH DICKSON, NRR/DRA/ARCB
LISA GERKEN, Framatome
JOSEPH MESSINA, NRR/DSS/SFNB
SCOTT MOORE, ACRS
JOHN PARILLO, NRR/DRA/ARCB
DAVID RUDLAND, NRR/DNRL
BARIS SARIKAYA, Constellation
ROBERT TREGONING, RES/DE
SUNIL WEERAKKODY, NRR/DRA

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

(8:30 a.m.)

CHAIR BALLINGER: Okay. This is a resumption of the meeting the Regulatory Rulemaking, Policies and Practices Subcommittee of the ACRS. I'm Ron Ballinger still chair of this subcommittee meeting. Members present and I don't have the real list, but I think Walt Kirchner and Dave Petti are remotely connected. And I don't --

VICE CHAIR HALNON: Vicki is also.

CHAIR BALLINGER: Who?

VICE CHAIR HALNON: Vicki.

CHAIR BALLINGER: And Vicki is on. Members present in the room are Craig Harrington, Tom Roberts, myself, Greg Halnon, Bob Martin, and Scott Palmtag. And our consultant Steve Schultz is here, and I don't know -- Dennis Bley is also online. So I am sure I'll miss somebody, but please let me know. I must remind you that this committee is running in accordance to FACA rules. I can use an abbreviated intro statement and the like, so I don't need to go much further than that.

VICE CHAIR HALNON: Vesna just came on.

CHAIR BALLINGER: And what? Okay. Vesna Dimitrijevic is now on. So I think we're definitely

-- almost everybody except for Scott -- except for Matt Sunseri, who may join us as well. So yesterday, we were going through the slide that's on the screen, and we had gotten down to number 8 and then one of our members disabused me of that fact and suggested that we need to continue the discussion on the control room dose before we go to the broader impacts. And so we turned it over to Dave Petti to at least start the discussion. So Dave, are you okay?

MEMBER PETTI: Yeah. So I just want to say I heard -- I didn't hear sort of consensus. I heard a number of folks who didn't like the use of the risk metrics to scale the control room dose, and some who just didn't like the higher value. But then I heard others who thought it was okay and didn't seem to have a problem with it. And given the fact that they were asked by the commission to just conform the rule, and there are other places where the rule is just conformed. So I think it's still worth discussion because I didn't sense anybody in consensus in the room on what we're going to say here.

MEMBER MARTIN: This is Bob. I didn't say anything yesterday because I basically agreed with Walt had said and wasn't going add to the echo chamber. But I thought we did have a little more consensus.

MEMBER ROBERTS: So when I left yesterday I wasn't really clear what Walt was saying. And so I wanted to maybe get back around to what Walt's proposal is, which basically is an accepted 10 rem proposal for some set of conditions and use a 25 rem for the most severe accident that's included in the design basis. Walt, is that a fair characterization?

MEMBER KIRCHNER: Sorry. I had multiple screens open. Let me make -- yes, I'll come back to what Tom was suggesting. But let me first start by saying by analogy let's look at things that we have considered reasonably that have been quote/unquote risk informed in one manner or other. So a good example of that is EPZ sizing. What we don't change is the acceptable dose, we change the distance in the case of the EPZ size. So we still hold to or recommend that the agency hold to, you know, the PAG, the EPA Protective Action Guidelines, and/or, you know, traditional dose consequence metrics. So having a sliding scale for the acceptable dose to me just doesn't make any sense. I think it's a misapplication of using risk metrics in this case. It would seem to me that you would have a design basis accident kind of acceptable dose. The current is 5 rem. I think there's good in the preamble, the proposed rule there is a good write up on this particular issue, and they suggest 10 and then up to 25 in the case of, as Tom was saying, severe accidents. To me, that makes sense based on the Fukushima experience and such. Once you have a severe accident, I don't understand why you would have a sliding scale. You would determine what's acceptable for this one-time exposure in an extreme, unusual case, and 25 rem seems to be a reasonable target. And then you'd manage the situation accordingly to not overexpose the staff.

MEMBER PETTI: But Walt --

MEMBER KIRCHNER: Having a sliding scale is just a misapplication, in my mind, of risk metrics.

MEMBER PETTI: Walt, your argument is based on the occupational things that happen. This is a design criteria for control room acceptability. So yeah.

MEMBER KIRCHNER: The granularity makes no sense to me either, but that's a different matter.

MEMBER PETTI: Yeah, I have a little bit --

MEMBER KIRCHNER: It's over application of technical calculational results without any consideration of the -- of who's being exposed.

MEMBER PETTI: Yeah, I don't -- if you've done those calculations you know there's enough uncertainty in the, you know -- once you have the source to just the calculation, right. I mean there's a whole protocol with chi over Qs and all of that stuff. I mean there's conservatism there, but you could easily come up 10 rem versus 5 rem, just change a couple things that wouldn't be considered, you know, outrageous. So I do think that 25 -- what I like to say is that what they're doing is aligning the control room -- the control room habitability dose and the control room design aligning the criteria to something that's more realistic to the occupational side. That's how I tend to think of it.

MEMBER KIRCHNER: No, that -- I agree with you. But those no need to invoke the CDF -- sliding CDF scale to do that.

CHAIR BALLINGER: Yes. This is Ron Ballinger. Where I come from and where Tom comes from, I think, we use 5N minus 18 and 25 rem in an emergency one time -- one lifetime dose. So going through 5 to 10, again, like Dave was saying, when you do these calculations that's in the weeds. The difference 5 and 10, I'm not going to, you know, fall on my sword by thinking I'm going to get cancer for 5 versus 10. But the 25 rem lifetime, that's been around for a very long time, and it's consistent with all kinds of standards and the like. But -- and so I don't -- even for control room design, why not just keep it that, 10 rem, 25 rem in an emergency or whatever you want to call it and forget the sliding scale. It just seems like sort of arbitrary -- not arbitrary -- but forced response or some kind of thing. Maybe I'm using the wrong words. But I think I'm agreeing with Walt. Just make it simple.

(Simultaneous speaking.)

MEMBER ROBERTS: I look at table 7 in the reg guide it actually does pretty close to what Walt suggested which is there's a whole sequence of either AOOs or non -- maximum hypothetical DBAs of that limits like 5 and 10 rem. But then there's that top rung that's the MHA LOCA which is not exactly a severe accident, but it's essentially a severe accident with containment not recurring that's not determined to function. Now are the 25 rem and the only 25 rem in this table then -- and that would seem to be consistent with Walt's proposal. That's what he trying to get clarity. If that's, Walt, what you're saying, I think that makes sense to me. Because it says that just for this artifice, it's only use for design criteria for the control room to get a control room that's reasonably tight for other scenarios that aren't analyzed, then that seems to makes sense. That way you still get a 10 or 5 rem criteria the scenarios that are closer to being real.

CHAIR BALLINGER: But isn't the 25 rem connected to reality?

MEMBER PETTI: It's aligned.

CHAIR BALLINGER: For design purposes we can use 25 rem, but in the real world that a limit that you can't exceed. Regardless of what the accident is.

MEMBER ROBERTS: Right. It's the same number for different reasons.

CHAIR BALLINGER: Right. But it's still, you know, why --

MEMBER ROBERTS: It can't be the same number. It's almost a convenience but it's the same number. But in reality, the 25 rem for this somewhat stylized scenario you may or may not get 25 rem with a severe accident as you manage it with severe accident guidelines, and it's almost fortuitous if you do or do not. You would manage this severe accident at 25 -- you would start with the control room that was as tight as practical which increases the probability you could manage the 25 and not be taking an operative --

MEMBER KIRCHNER: Part 20 rules are still in effect.

MEMBER MARTIN: Exactly.

MEMBER KIRCHNER: So --

MEMBER MARTIN: I just think whether we're over thinking this.

MEMBER KIRCHNER: Yeah. That's what I mean.

MEMBER MARTIN: I mean, this was all, of course, driven by the high-level topic you're increased which meant longer cycles, you know, the engagement with industry basically says, 5's not going to work anymore. Is it a big deal to move to 10? Sounds like a pretty simple change, whether it's 10 or 25. I think I agree with you guys, there is probably not a big, big change here. But there is the Fukushima where when the event happened -- of course, it becomes a radiation protection issue not so much a design issue where, of course, they upped the control room criteria or whatever it would have been in that case or a radiation protection to a 25 which I think may still exceed it in that case. So it was an immediate exception, so I just think you just go whether it's 10, 15, 20, 25, seems like everyone was happy with 10. You know, that's the easy button because it's, of course, maybe more conservative, doesn't really change the methods, it doesn't change a lot of things. I don't think anybody was complaining about 10. It seems like a natural --

CHAIR BALLINGER: What we're discussing is the sliding scale.

MEMBER MARTIN: Well, I know. That's why I said I think we're over thinking that kind of detail. Just make the small change and everybody's happy.

CHAIR BALLINGER: Dave probably knows the answer to this but in these calculations when you calculate the 25, what's the uncertainty the on the 25?

MEMBER PETTI: Yeah. I mean --

MEMBER MARTIN: You incorporate that in there.

MEMBER PETTI: All I'm saying is that I think we're -- Tom went exactly where I was going. That for a certain class of events the acceptance criteria will be 10. Those are the quote less severe. But for the MHA LOCA, it'll be 25 because you're getting closer to, you know, severe accidents and it aligns better with -- at 20 occupational standards. That's all I'd say. And then we could say that, yeah we don't -- we think that the, you know, that the risk application is a little forced bit. It doesn't need it. I guess I don't care about that as much.

MEMBER DIMITRIJEVIC: Yeah. This is Vesna. I mean, I completely -- my point is the same. It's a little forced. We don't really have a direct connection should that be called demonstrated maximum hypothetical accident. And the one thing which we don't even consider is the importance of operator actions in certain scenarios. So since we can ultimately make logical connection between then why make this fine tuning into the four things? I mean, having the two limits make much more sense.

CHAIR BALLINGER: I mean, just saying that we're -- it adheres to occupational standards, end of story.

VICE CHAIR HALNON: I just want to make sure that we continue to keep separate occupational standards and the reference value that's being given to evaluate features of the plan based on an accident. And that's -- it seems like we're continuing to jump over, oh, operators shouldn't get 25 rem. That's not what this is saying. This is saying you evaluate your control room as a feature of the plan against the accident dose and if it's over this number then you have to either change the accident or you have to change a criteria like leakage or something else. But it doesn't say that from now on we're going to involve -- you already get 25 rem in the control room during MHA. That's handled by the different regulation and it's something separate. This is simply a reference value. I mean, we could show as a control room leakage instead of dose. We could have chosen thickness of the wall or something to that effect instead of dose, but instead it makes more sense comprehensively to choose a dose number because that encompasses all of these different things. So then, if you start with that premise the 10 rem versus 25 rem, why not allow the site to say, if I have this accident gives me 11 or 12 in the control room, I can say that's acceptable because I have a very unlikely event and its below 10 to the minus of whatever, we're at CDF, LERF or some other value from this. So I'm not saying that -- yeah, you could make a case that it doesn't make any sense to say CDF versus dose, and you could have a sliding scale. But what else would, from evaluation of safety of the plan or the likeliness for frequency of the accident.

MEMBER PETTI: So, Greg, if we could just -- I mean, if we go back to that table we say the less severe events have a 10 rem target, and the MHA LOCA has a 25 rem target. That's somewhat in a sense risk informing. Because you're creating it based on the severity.

DR. SCHULTZ: This is Steve. Dave and Greg, I agree with you the -- with the approach you're describing. We talked a little bit about Fukushima and if you think about how the site responded to the event, the control room dose was high. Those that received doses which approached and exceeded 25 rem were in the control room. They weren't necessarily operators in the control room. And, in fact, when -- if you look at emergency preparedness and planning associated with U.S. plants, the control room is good to be designed at the level for 25 rem for severe accidents and below that for the other accidents. And 10 rem is a good target as is described in the graph guide. So I think that approach is appropriate. For a risk-informed approach, I think the overall approach would be associated with identifying the likelihood of the events and certainly the severe accident event of MHA LOCA, as we've described here in the last few days, has a very low -- going to be very low probability. The other point is that there's one point in draft guide that I think deserves some attention and that is, there's a -- there's a comment in the draft guide that says for new reactors the technical support center should be set at the control room dose, but then selects a limit for the technical support center of 5 rem, which I think ought to be moved to 10 rem. If you think about emergency response, the decisions associated with who does what outside the control room is really dictated by and established by the technical support center. And it's usually the technical support center that makes decisions who might go out into the plant the way they did at Fukushima. Who might go out into the plant and receive doses above the standard occupational dose in response to an emergency.

VICE CHAIR HALNON: Steve, doesn't the technical support center get evacuated at a certain dose and change its function over to the EOF which is equivalent to the abilities in the E plants?

DR. SCHULTZ: It may. But I was talking about the decision making that associated with those plant employees that might be asked to volunteer to receive --

(Simultaneous speaking.)

VICE CHAIR HALNON: That's the stage where actual decisions are made by the emergency director which follows wherever the habitability would be.

DR. SCHULTZ: Correct. Correct. We talked a lot about the operators receiving 25 rem at Fukushima and -- in terms of emergency response. They're, in fact, not likely to be going out into the plant to do things in the event of a severe accident.

VICE CHAIR HALNON: I agree that there needs to be a synergy there that makes sense. And I hadn't looked at it for the same point of how it all fits together, but probably could make a case for it.

DR. SCHULTZ: The other comment that the sliding scale that has been developed within the reg guide is an interesting one. I just don't think its application to control room dose -- sliding scale control room dose makes the most sense. It does make an argument that this would be the performance based part of risk-informed and performance based. In other words, a sliding scale based on risk-informed would look at the likelihood of the event, including performance based, is an attempt -- and I think in other instances it ought to be used -- an attempt to give credit to those sites that completely gone of PRA and have good results as a result of the effort of the actions taken due to the PRA.

VICE CHAIR HALNON: And I'm fine backing you're statement, Dave, with making it simple if we can show that that's simple for everybody, not excluding someone like what Steve's saying, someone who's done a lot more work may be could get more margin overall. A better treatment by the rule if they've done more work. I just do want to eliminate that potential.

CHAIR BALLINGER: Well, we can -- as part of our letter we can make -- we can outline what we're saying. But it's really up to the pilot studies and the workshops that'll go forward that'll eventually sort this out. So I don't know that we should be saying you shall do this as opposed to, consider the following, and let that get sorted out as part of the overall discussions of the rule.

VICE CHAIR HALNON: I think that we can agree that it's a risk-informed approach. I mean, that's pretty aligned. We're all agreed that those suggestions that exist being and in keeping what we say the simple method is a risk-informed approach. I think we're saying that. There's an opportunity here to use a risk-informed thought process and make it real simple as opposed to putting in more detailed processes that's dependent on a potentially unrelated or -- maybe not unrelated -- but loosely tied risk metric. I wouldn't say that we wouldn't indict either one but --

MEMBER MARTIN: And I want to -- this is Bob, I want to defend the folks that do the analysis, right. They have methods already and, you know, much of a deviation from how they do thing is churn. Now, this is not like changing LOCA methods or anything. It's not quite in the same ballpark. But nonetheless, I mean, there's public comment later, you know, on what you want. But I just had the impression they wanted simple, you know. And I don't think risk-informed in some articulation like we have now or even a lighter version of that is necessary. Drawing a line in sand just continues to support what we've already had, which of course is fine. But now that we've moved to the changes with cycle lengths and what have you, you need more, we just move the line and they can continue to use the same methods, just with a different criteria, slightly different criteria. If that's good enough, we just can -- simple and move on. It doesn't disrupt what analysts do. Serves its purpose. So anyway, in defense of analysts.

CHAIR BALLINGER: I've got a hammer, I'm

going move on that nail.

MEMBER MARTIN: Exactly. Everything looks like a nail.

DR. SCHULTZ: The analysis for control room -- this is Steve. The analysis for the control room dose is not a simple exercise.

MEMBER MARTIN: It's not LOCA.

DR. SCHULTZ: And with the appendices changed in rev 2 of the guide, it makes it more of a challenge for certain in the MHA LOCA. And when we consider that what MHA LOCA could be classified as a severe accident, I would agree that 25 rem makes sense for that evaluation. And 10 rem for the other evaluations for the control also makes sense based on the arguments that are in the reg guide as well.

MEMBER ROBERTS: I have a quick question for Elijah. Just following up on Steve's question of the TSC. There's some discussion about the TSC requirements and thereby the control room requirements, are they the same. But there is one sentence in the draft guide that says that the 5 rem criterion applies. Is that a typo or is that an intended difference?

MR. DICKSON: This is Elijah Dickson with the staff. I think that's something we massed. So it's a typo. Yeah.

DR. SCHULTZ: It refers to 10 CFR. But there's really no value in 10 CFR associated with the technical support side.

MEMBER KIRCHNER: Ron, this is Walt Kirchner. Just a question for the staff. Elijah is there. Elijah, is there -- as part of the rule, are you going to change Appendix A Criterion 19?

MR. DICKSON: Yes. As part of the rule GDC-19 would change to be consistent with 10 CFR 50.67. So the proposed rule language would change the value from 5 rem to 10 rem, and then we an additional paragraph that allows for this -- effectively this sliding scale to go up to 25 rem based off of plan specific risk information or, in this case, we put into the guide was utilizing or leveraging the CDF information from their PRAs.

MEMBER KIRCHNER: Thank you.

MR. DICKSON: In the presentation I gave last month there is an example of that language. I think it was on 17th. That was the first day I gave it the presentation. But similar conforming language to GDC-19.

MEMBER HARRINGTON: This is Craig. Elijah, is there any sense that the sliding scale not just as an opportunity but maybe an incentive to the plant?

MR. DICKSON: Yeah. So as we wrote it in the federal register notice in the draft documents you all received, we based the sliding scale from commission policy and SECY-98-144 that asks us to develop performance based and risk-informed rules that do provide incentive for increased safety, right. So the intent here with this sliding scale is to leverage the PRA site-specific risk information or other information, right, to allow for a higher value. So if the facility itself is designed and has a low CDF value, then we are considering that they don't need to be held to the same standard as those facilities that have a lower CDF value. So we're trying to provide that incentive for plant designs. The thought is, for instance, the AP1000, right. They have 1e to negative 7 type CDF value. Do we want to hold them to the same standard for this MHA LOCA as some of these Gen 2 plants that we have at lower CDF. So we're trying to provide some incentive with the rule language itself, and then our proposal to provide that incentivization is in the guide, is based off of this sliding scale.

MEMBER HARRINGTON: So if we don't have a sliding scale, the incentive concept just goes away.

MR. DICKSON: Right. And we have a thought process being drafted up now in an enclosure to the SECY paper, and it's talking exactly about what you all are talking about here. That where we looked at three different options, the first option was just update the rules at 10 rem. There's plenty of information to support that. Option 3 was to update it to 25 rem. There's plenty of information to support that to as well. But as the staff we felt that we could find something in the middle between 10 and 25 rem that could provide some incentive for facilities to make some operational changes or some design feature changes that might decrease their site-specific risk and gain a little bit of incentive in the control room design criteria itself. And that makes sense if you have a facility that has a 1e to negative 7 type CDF to allow them to have a higher design criteria to add for additional operational flexibility at the facility. That's the thought process. We have it in a enclosure to the SECY paper. When you guys see -- you don't have that one, I don't think. But when you guys do see it, or when ACRS sees it, I highly recommend taking a look at it and you could see our thought process there. And Sunil wanted to jump in.

MR. WEERAKKODY: I'm the senior advising PRA in NRR. Am I allowed to say something on that? So I worked with Elijah and my then-boss Mike Franovich very closely with respect to whether or not we should have a sliding scale. And Elijah gave a great example with AP1000, but I want the committee to benefit from some of the other thoughts as they apply to the operating plants. We really wanted to do something even for the operating plants. There are plants out there who are developing a risk-informed culture and based on that, when they do the math, the capital budgeting gives them more of an incentive to lower their risk. As a case and example with respect to the FLEX strategies, there were some plants who went out and bought two extra diesels, big size, and that -- and they change their seals and that's a significant reduction to their CDF. So I was listening, and I know it brings this added complexity, but I want to emphasize that the thought process was we really want to get to a paradigm where the regulator is continuously motivating our operating plants also to enhance safety. So that was the thought process. So hopefully that helps Elijah. I was working with Elijah. We had some difficult conversations among us talking about some of the exact same things. You know, the added complexity. Why can't we keep it simple, because we have plenty of information to support a claim. So thank you for your patience. I was out yesterday. I will answer any questions if you have any.

CHAIR BALLINGER: Thank you. Weidong, can we get that enclosure?

MR. WANG: It is part -- I think it's a white paper.

CHAIR BALLINGER: Or whatever it is. Whatever you're talking about.

MR. DICKSON: Yes. So, I mean, there is a white paper on this as the basis for this sliding scale. But the staff's decision-making process and moving forward with the rule making, it's an enclosure to a SECY paper that will be made available. It's not available yet. You'll see it in the rule making package.

CHAIR BALLINGER: Whatever gets discussed at one of these meetings has to be -- we have to have access to it.

MR. DICKSON: Right. Okay.

MEMBER PALMTAG: This is Scott Palmtag. Elijah, I just want to have clarification. A sliding scale it gets applied to the dose for all accidents.

Is it all accidents or just the LOCA?

MR. DICKSON: It's just MHA LOCA. The maximum hypothetical accident, not all the other accidents.

MEMBER PALMTAG: So what's the proposal for all the other accidents? Keep those at 10?

MR. DICKSON: At 10 rem for all the other accidents for the control room. And then for the EAB, exclusionary boundary, and low population zones those would stay the same.

MEMBER PALMTAG: Okay. And the sliding scale is just for MHA LOCA?

MR. DICKSON: Just for MHA LOCA.

MEMBER PALMTAG: Okay. I did not understand that at all so --

MR. DICKSON: Understood. okay.

DR. SCHULTZ: Elijah, you mentioned that this is going to be described as a general topic in terms of the overall approach, that is the sliding scale. Here, the decision was made to apply it to control room dose for the MHA. Are there areas of the rule that is going to have something like this in terms of a sliding scale for applications? Talked about use of PRA in other applications. But did you hear anything about if there was special things that might apply to a plant with a very low CDF or --

MR. DICKSON: This scale, to my knowledge --this type of approach, to my knowledge, isn't being applied to the other areas of the rule making. So if you're referring to 50.46, no, it's not being applied there. Joey?

MR. MESSINA: Correct. Correct.

DR. SCHULTZ: Okay.

MEMBER ROBERTS: Slightly different question. Maybe you can help answer this question. Direct Guide 1426 which I don't think applies for this part of the rulemaking, but Direct Guide 1426 has I think an interesting paragraph on risk acceptance other than probable risk assessment and on screen, the first couple of sentences in the paragraph it says, even with a PRA that addresses all the relevant initiators and operating modes, many proposed facility changes may affect equipment that is not explicitly modeled in the PRA, and it goes to the example of containment leak detection systems. It seems to me that a control room would also fall in this category. That the command and control that you get from being in the control room is somewhat intangible, and I don't know how well that's modeled in PRAs in terms of how decision making would be degraded if operators had to control it from someplace farther away. Is the intent to apply that concept when evaluating control room dose increases?

MR. WEERAKKODY: I'm not sure. I might be answering the wrong question. There is -- you are referring to DG-1426. I believe that's direct guide the in support of the 4056A. I wouldn't mix the two because really for the control room dose -- that's the one that I worked with closely with Elijah -- we already knew that there's a stylized accident that they use to come up with the same criteria for the control room. And then we said, okay, we want more to get licensees who are safer to give more flexibility. And we kind of talked about, you know, what is the best criteria -- not the perfect criteria -- that can have a correlation between MHA and LOCA and then we can adapt it to CDF. You know, we could have taken things like LERF. But I will not -- I mean that's, 1426 was written with a completely different mindset. So I wouldn't venture to try to connect the two.

MEMBER ROBERTS: All right. It seemed to be the same concepts applied. That the -- if you have a control room that was leakier that was permitted by the rule, and so, you know, an applicant were to change the filter design or a tech spec that allows for more leakage in the control room or the way they manage it and those kinds of things, then that would increase our risk in Level 2 PRA because maybe you don't control the dose to the public as well because you're not as effective in manning the control room. And so it would seem like the evaluation of a design change enabled by this rule would have very similar logic as to their -- the thing I just read that you want to understand what is the risk implication of having let's say a leakier control room if you ran us through an accident scenario that's well beyond what is in the MHA LOCA.

MR. WEERAKKODY: I would 100 percent agree. This is Sunil Weerakkody. I do 100 percent agree that there is a correlation, but we are balance the state to getting too much complexity down to the degradation. So that's why I said you're right on. You know, those exact same things apply here as well.

MEMBER ROBERTS: There was a sentence in Rev 01 of the Reg Guide 1.183 that got deleted or rewritten, I couldn't quite tell which, in Rev 2, which would have the applicant, you know, evaluate the implication of any change enabled by the AST on risk, either through active management or a PRA. And so it's a very, again, similar concept that's in the

Direct Guide, but for some reason that got deleted or revised in Rev 2 and I wasn't quite sure what the intent of that was.

MR. DICKSON: Yeah. After -- this is Elijah Dickson with the staff. After our discussions last month, I went and took a closer look at that. And we made a lot of improvements in regards to defense in depth and safety margin discussions, and I believe that's sentence was in the Defense in Depth section. We brought in concepts from Reg Guide 1.174 to have seven or eight concepts that are really good to think about in regards to defense in depth. And then we made additional edits to that section, trying to provide examples of what we would be thinking about in a severe accident. So we talked about, like, the IPEs and some other areas where you could be considering severe accident mitigation. But it's -- you're right. It's not as direct as to go look at severe accidents, make sure that these design changes are not impacting things like EOP and SAMGs, I think is what you're referring to. Now, what are the follow-on effects to making design changes under severe accident conditions. And that sentence, could it be added back to it? I believe. But as well as, you know, maintain some of -- giving some examples of what you should be thinking about in severe accidents. So that was, I think, a good thought of Member Roberts.

MEMBER ROBERTS: Yeah. And I think it's there. It's just it was clearer in Rev 1. And I think it's clearer in Reg Guide 1426.

MR. DICKSON: Yeah.

MEMBER ROBERTS: And so it might be, you know, worth looking just to make sure you caught the right guidance and what kinds of evaluation to expect. It's not just a matter of making numbers, you have to also look at, okay, those are all based on stylized scenarios that aren't the scenarios that we think are risk significant scenarios. So what is the role of the control room in those scenarios which probably is not modeled all that well in the PRA. I think you agree with that.

MR. WEERAKKODY: Yes, sir. This is Sunil. I believe I can -- the way I'm internalizing your feedback is we have DG 1426 and then you have Reg Guide 1.183. The way I'm thinking of that is, you know, there should be some high-level consistency. You know, it's the same rule. You have two different Reg Guides, and thank you for that.

MEMBER ROBERTS: Yeah. And the other

point is to make sure that we don't lose the fact that this -- these scenarios are stylized in Reg Guide 1.183, and at least it seems to me the real goal is to support sort of active management and if there's some control room degradation that's allowed by the stylized scenario that would adversely affect the accident mitigation, I think you weren't looking.

MR. WEERAKKODY: Definitely. Yes.

MEMBER ROBERTS: Okay. Thank you.

DR. SCHULTZ: Along those lines, Elijah, when the -- I'm recalling back when the alternative source term was first proposed and developed by the NRC and the industry, the question associated with control room unaffiliated in-leakage came up. It was a -- I'll call it a requirement of those adopting AST to do unfiltered in-leakage testing in the control room. And you mentioned that had the other day that is still being -- that is still the expectation is still the -- and I don't expect that any plant would take -- would make design changes as a result of these changes associated with moving the dose limits up to degrade the occupational protection that's provided to control room operators.

MR. DICKSON: Yes, you're right. There is a whole program in regards control habitability.

Every 7 years they do a tracer gas test. And that was based off of operating experience from the late 80's and early 90's were they found that the control rooms were much more leakier in design and so that kicked off a whole regulatory initiative to tighten these control rooms back up, put in these programs. They are controlled in the aspects that you mentioned and on administrative controls. And the values that they use in the consequence analyses are rather usually several factors higher than what they're actually testing at. And that's something that we assess. When we receive an amendment, often we'll ask them, you know, what is your testing data for the control room. And we can see whether or not there's enough defense in depth there. And then, of course, the additional margin that may have to provide, you know, in case they had a bad testing day. That's what that margin is there for, to handle that from an operational point of view.

DR. SCHULTA: Thanks for the additional information. That helpful.

MR. DICKSON: John Parillo, my coworker, has his hand up.

MR. PARILLO: This is John Parillo. I work with Elijah and for the staff. I would just like to point out to the committee on Table 7.1 which -- of the Draft Guide listing the changes to the dose criteria, the acceptance criteria, that one of the concerns that we had was that by relaxing the control room criteria, might -- as being discussed, might have an unintended consequence of reducing the effectiveness of the control room design's protective safety system such as the filtration systems and so on. And so what we did was, if you'll notice for the accidents that have a source term which is based on the coolant only and the assumption is that that source term is not going to be affected dramatically by the increased enrichment and higher burnups and so on, that we maintain the lower acceptance criteria, 5 rem, for those accidents. So sometimes those accidents do, you know, challenge control room so that -- in other words, what I'm trying to say is we do not expect that by virtue of relaxing the acceptance criteria that it's going to result in a degradation of the effectiveness of the control room because they still will need that effectiveness to meet that lower acceptance criteria for those accidents which are the concurrent spike accidents for steam generator 2 rupture and main steam line break. So I just wanted to point that out to the committee. Thank you.

DR. SCHULTS: This is Steve, John. Thanks for the clarification.

MR. PARILLO: You're welcome.

MEMBER PETTI: So he based on what I'm hearing, here's had the concern I have. I think we all would agree that we support the staff trying to incentivize plans to enhance safety. So when you think of the thought process that Elijah said they went through, I think we agree with the thought process. In which case they're just using CDF as a metric for better or worse to try to incentivize the plants. So this is where I think it's a struggle because I think otherwise I think we are kind of aligned on, yeah, MHA LOCA is the only one that this way applies to, 10 rem to the less severe events. So that's, in essence, a form of risk informing because the frequency of the events versus the dose, you know, are aligned there. But how do we -- the idea that it's a forced fit using CDF versus incentivizing the plans to enhance safety, I'm having trouble figuring out how we bring those two together.

VICE CHAIR HALNON: And, Dave, may be very well what the letter needs to say. And we don't have to couple up with a final answer today because we've got a lot of work to go, a lot of workshops, and other discussions. Any guys generally in favor of what we're doing, maybe there's a better way of doing it as they adjudicate it through a workshop type of atmosphere. We certainly should hold this in our letter as on open item the or some other whatever we want to call it that we're going to reengage on to see where the industry and NRC come to a meeting of the minds on down the road. And it may be very well the same thing to know we can express a little bit more.

MEMBER PETTI: Okay. I think -- I can -- I've been taking notes, so I guess, Ron, I will try to write up something on this one. Because there is going to be some homework when we're all done on each of these areas and who's going to take the lead and write something up for the letter.

CHAIR BALLINGER: Good plan.

MEMBER PETTI: I think if there's no more discussion, we can move to the broader impacts.

CHAIR BALLINGER: Okay. So now we're on number 8, and it's a kind of open discussion I suppose as it always is. And look for input from members on broader impact. I think we kind of alluded to these and actually mentioned some of these in previous discussion yesterday related to this, what I'd call the tentacles that this rule has out into the rest of the system. So that included, you know, power upgrades which have been discussed, and then other issues which I'm drawing a blank on, but I know there were a couple.

MEMBER PETTI: Yeah. So I've got lists here that -- I mean, this -- I was -- what happened is that Tom had put together something that liked good about, you know, how we're taking deterministic rules and we're trying to risk inform them. And he was focusing somewhat on severe accident risk. I had written something about making sure the staff continues to think about other parts of plant safety because this is kind of like having heart surgery making sure the rest of the system still works, right. I think Bob had talked -- had some comments relative to, you know, looking at the effects on EPZ and SAMG. I then further raised issues on tech specs and aging management based on what we heard on yesterday morning. So my picture is a -- something in the letter, you know, a comment that not that anything has to necessarily change, but that the staff continue to think about these things in the broader sense. And we can list these items to show the commission, look, this touches lots of different things. That's sort of my sense of what would be a good conclusion of something to put in the letter.

CHAIR BALLINGER: Yeah. I mean I think that we can make a list but stress that it's not complete because we might leave something out. And I'm also guessing that the staff has got their own list somewhere. Hopefully they overlap. But, yeah. Yeah.

VICE CHAIR HALNON: That kind of follows my question about, you know, when I take this shift the day after it's implemented, what am I going to see different. The effect on the control room operator to me is one of the more important -- I get all of the analysis behind the scenes and stuff like that, but it's not -- that doesn't do a lot for me to operate a plant unless I can see increased operating margins, a few more tech specs to have to comply with, and those sort of things. And I wrote on the key analysis, a lot of this is an analysis of design space, but it's really where the rubber meets the road is how does it affect the control room operator and as Steve was saying, going beyond the control room to the TSC and the EOFs and that's so the EP effects of it. I'll make sure we stay focused on practicalities as well.

MEMBER PETTI: No, I agree. That's why I sort of raised issue on, you know, amps and the tech specs. I'd like -- I think it'd be good if like Bob and Tom worked this one because they were the ones who had good words and roll in these other items that we've talked about for the last day and a half.

MEMBER MARTIN: This is Bob. Where I kind of fall on these broader issues, you know, we can -- hopefully we don't get a certain level of complacency regarding all the work that's done to, you know, risk inform, you know, the accident analysis, the focus on fuel, and project that I think we have the same understanding beyond that of the containment and new leases and stuff like that. I'm a little bit more conservative in the sense that I still believe deterministic design criteria be moved out, you know, the final barriers or the final barrier for sure to cover residual risk. It's probably not a popular idea. But I'm fine with a certain segregation of how we look at different problems as the design basis. We've done a ton of work, you know, with LOCA. We understand fuels quite a bit. We understand, you know, how water works. The methods going beyond that are just not as well characterized as we've done there. And to say we have a different method or different -- maybe the old method for how we approach containments, EPZs, and that sort of thing, doses, I have no problem making -- drawing a line and saying these are different problems. We have, you know, a -- different inputs to that. So I don't know if I'm as comfortable with blending -- harmonizing methods across the different kind of physical defenses. A quick sound bite there. So in some ways it's also saying, let's just keep focus on what we know and the immediate problems, immediate challenges, immediate interests and what the industry is looking for with longer cycles and, you know, keep us in that smaller box. And if it looks a little messy because we have, you know, these different boxes of how we approach things, we live with it for the time being as we continue to gather more information and support better methods. I think as we get into mechanistic source term solutions and see more of those, we'll get better confidence about where we can go on these other questions. But I don't know. I'm a little anxious about doing too much.

MEMBER PETTI: Well, again, I'm not arguing that we change anything. What we're saying is that the staff should continue to think about the impact of the rule in these other areas where there's subtleties. Again, they may never see an LAR, but better to be prepared, right, in advance to have thought through these things. You know, what struck me was I asked the question, and they say, yeah. We're thinking about it all the time. And I'm like but you didn't tell us, you know. I mean because those are -- when you write a rule -- this is why writing regulation is not easy, right -- you've got to think about the unanticipated or, gee, I didn't really mean it that way. I mean, people read things differently and interpret things differently which is why they've got to have all these workshops. But the other thing I worry about -- because, you know, we've sat here in other venues -- is we tend of think of things in a very integrated sense. Whereas, the way the staff is organized, they've got, you know, expertise in each specific area. Now, they are working together to help, you know, assure sort of an integrated look. But that's what our role is. And I just want -- it's a more positive thing to say, keep thinking beyond just, you know, the analytical stuff inside the core about what this could be. That's all I wanted to put in there.

MEMBER MARTIN: I certainly have no disagreement with that. I think I'm saying the same way, just another way. There's always going to be -- you know, as we make changes, there's going to be some tension because of the points that Dave raises. And as those tensions, you know, become more evident, we should inherently be looking at recognizing them and looking at them and planning the next. I think the -- you know, one of the biggest things we worry about is that, you know, lot of, you know, these what are called projects, but obviously rule making is a big deal, that there is a commitment until you kind of get to a milestone and then all of a sudden things go dormant. I mean, we kind of heard the story about, you know, DG-1216 yesterday and it goes up to 2016 and then goes dormant. And that just -- obviously our body is going to go, well, give me the key point. And recognizing the tensions that are there and doing the investment, gathering of information which are more with proposals for new policies or rules.

VICE CHAIR HALNON: So one other area that -- well, there's probably several, but we heard several times in the spirit of simplicity the control room dose discussion, we heard several times that the complexity and some of the processes to get into using parts of the rule may be difficult, and in some cases and add burden, add dose, add inspections, that sort of thing. We should emphasize the need to root those things out during workshops and try to work the other way so that people say that would be an easier way to do it. And it bounds -- maybe retain the complexity. If you need to have margin, you can do a lot more work instead of more money in the analysis but allow a more simple bounding process. If you have a plain margin and that would also serve the new actors coming in as well in the safety margin than the ones we have now. So I think that would be an important point to make. This is sort of a letter to encourage the industry and staff, not necessarily so much inform the commissioners of where all the issues are. I'm sure there's plenty of drop-ins and other information coming your way saying that we acknowledge the same areas -- like Bob says, areas of tension, and that we're going to be watching those may give them some comfort. But also, to make sure that we encourage these issues to get through the process just to go forward and then do it promptly because there's not a lot of time to work through it.

CHAIR BALLINGER: Okay. Speaking of not a lot of time, the rubber is about the hit the road here, in that we have to produce a letter, and it has to be produced by February the whatever. And so what I would suggest is that we have a discussion now that we can agree on not the exact wording, but conclusions and recommendations that we have to form the letter around. We can get consensus or sort of consensus around that, that'll help me an awful lot and it'll probably also help everybody who have been assigned, if we want to do that, various members to do various things or address various areas, although we really to let all members comment on anything that we want, of course. I would also remind people that this -- and Larry keeps reminding me the same darn thing -- this is a draft rule. It's not -- unless it's really something we think about, we shouldn't be sticking stakes in the ground and hills to die on in the letter because of what is going to happen going forward. What we should be doing is making, as we always do, constructive suggestions that would allow the staff and the industry to deal with them in workshops and maybe include some of our thoughts in their thinking. Along those lines, the letter from NEI was dated 1/22/25. And so I would suggest that members read that letter.

VICE CHAIR HALNON: Wait a minute.

CHAIR BALLINGER: No. January.

VICE CHAIR HALNON: Yeah. Of '24. You said '25.

CHAIR BALLINGER: That's what I meant.

VICE CHAIR HALNON: Okay.

CHAIR BALLINGER: That's what I meant.

Oh, I thought there was one that was right after the December subcommittee meeting because I was told by NEI that we only got this rule a week ago. Anyway, it's a good thing to read to provide a little context, if you will, with respect to options -- all the various options from the various stakeholders and things like that. Not that it would -- you know, not that it's something that needs to influence our discussion, but it's a point of reference, if you will. So all that being said, I am sure that Dave will disabuse me of what I just said.

MEMBER PETTI: So yeah.

CHAIR BALLINGER: I would like to see if we can have a discussion on the major conclusions and recommendations that we would put in the letter. Now, I see 1 through 8, maybe that's a sort of thinly veiled attempt to do that.

MEMBER PETTI: Exactly.

CHAIR BALLINGER: Okay. So it's not so thinly veiled.

MEMBER PETTI: No. No. But let me -- before we go there, the there's one thing that came up, hit me listening to industry and we've never said anything. You know, the staff decided, based on their reg basis, to go with option two. But I heard a number of comments from industry about Option 4, Option 5. Do we want to say something about --

CHAIR BALLINGER: If you look at that NEI letter, there's a lot of discussion of those things in there. In fact, that's all that's discussed in there.

MEMBER MARTIN: This is the major topic of the letter. That's right.

VICE CHAIR HALNON: And Theresa said in her opening remarks that they were working on the ALS review. I think that we talked about -- one of my comments about the incremental -- I won't say that -- it's improvement that we're doing this. It's not the boldest move we can make, but it's a move that probably appropriate in this time and frame with the amount of change. We should continue to work on the next level of that improvement which, to me, is the ALS option to eliminate the large, big bulk of discussion, potentially. So I think that should save it. I think we should hold that as that's the next point and that it should be done promptly and continue the process, not just for the existing fleet, but as we go forward with the new SMRs and other light water type reactors.

MR. MESSINA: Joe Messina. Can I just correct? The ALS does not remove the large break LOCA completely. They still have to do the PCT and MLO evaluation. Just dispositions FFRD.

VICE CHAIR HALNON: Yes.

MR. MESSINA: Okay. Just wanted to make sure.

VICE CHAIR HALNON: Yeah. Thank you, Jim.

MEMBER PETTI: So okay. Yeah. I have no problem with putting something in there about that. Who would like to volunteer that one? Don't all jump at once.

VICE CHAIR HALNON: Craig raised his hand.

MEMBER PETTI: Craig did. Great. Great Craig. Thank you.

MEMBER HARRINGTON: That means we have to consider whether I can though.

VICE CHAIR HALNON: Yeah, that's true.

CHAIR BALLINGER: Well, let's just go down the line then. I mean, what is the conclusion and recommendation in that area?

VICE CHAIR HALNON: I think it's a short one.

CHAIR BALLINGER: Okay. Well, what is it?

VICE CHAIR HALNON: It is to accept this

incremental improvement and to continue to work on the next level of the ALS to convince the -- the FFRD is the big question mark in all this.

CHAIR BALLINGER: So that's an overall conclusion regarding the entire rule.

MEMBER HARRINGTON: I think that the ALS piece is parallel to the rule.

CHAIR BALLINGER: Well, that's what it says in the NEI.

MEMBER HARRINGTON: ALS helps move forward with the immediate problem in the schedule that the industry is pursuing that was described to us yesterday to allow them to move forward with increased enrichment. It's not taking anything away from the rule, the broader proposed rule. That should still go forward because it does more and other things.

CHAIR BALLINGER: The ALS is not 1 through 8. It's separate.

MEMBER PETTI: All right. I think that's a good way to end. It would be like our last one because it would, you know, point to stuff sort of outside, you know, what we were asked to look at.

VICE CHAIR HALNON: It removes a large piece -- uncertainty is not the right word probably because -- a large piece of the regulatory uncertainty going forward.

DR. SCHULTZ: It goes after the broader impacts and broader opportunities that you might -- that should be.

CHAIR BALLINGER: Because I keep coming back to the NEI letter. They talk about not just Option 5, but Option 4. It's on BWRs, all kinds of stuff. And then combinations of Option 4 and Option 5, ALS being Option 5, and the like. So there's a lot of discussion and it's not just ALS.

DR. SCHULTZ: There's the opportunity and there are effects on all of the points and all of the designs. And some are getting more benefit than others in the selection of 2 and 5. And 4 is something that the BWRs also said they needed to pursue.

CHAIR BALLINTER: Well, Craig?

MEMBER HARRINGTON: It seems to be that Option 4 going to be pursued in these workshops because that's going to be the focus of the BWRs. So it sounds like it's similar to what we talked about last night with the prioritization of the best estimate LOCA methods. There's another prioritization of does the rulemaking comport with alternative 4 and the needs of the BWR. So it may be the same conclusion, I'm thinking, that we'll eventually get to on the prioritizing the LOCA description. It's just a question of, you know, prioritizing the workshops and focusing them on these items that are identified as important. So I think ALS really solves part of the problem, which is the PWRs. And maybe that's a separate deal. I think we can note that we encourage the continued rapid evaluation of the ALS system with the need to be thorough.

MEMBER PALMTAG: Based on regulatory uncertainty though, I'm kind of concerned that we're moving forward with these rules and, oh, by the way, we're also doing ALS. That may be coming down the pipeline. Oh, by the way, we also -- maybe having an Option 4 down the pipeline. It seems like --

(Simultaneous speaking.)

CHAIR BALLINGER: But the EPRI folks have submitted and submitted -- I want to -- I think four, three plus another one that we haven't seen of shouldn't have seen -- topical reports related to ALA.

MS. CLARK: This is Theresa Clark from staff. So yeah, I think as I've mentioned yesterday and possibly other times, these are the records are going on in parallel with the rule making. ALS is one that's under current review. We're talking about how we might be able to approach alternative 4. One of the key things that we're thinking about is ensuring that we have a rule that is inclusive and enabling. I'm not sure I'm aware of any content in the current rule that would prevent these other alternatives from being pursued. I just recall that they are alternatives for dispositioning FFRD. Option 2, which is in the rule, not only does FFRD, but enables a large variety of other source of operational changes like were referred to earlier in this meeting. So it was definitely ambitious to put it in there but could be very beneficial, not to say we can't think about these other things that might provide a more narrow benefit.

MEMBER PALMTAG: Yeah. I'm sorry. I understand that, you know, all these different options do different things, but there seems to be a lot of regulatory uncertainty when they don't really know what's going to be fine lance or fine lancers coming down the road.

CHAIR BALLINGER: Now I'm getting fuzzy because I see 1 through 8, I don't necessarily agree with the order or the number. But anyway, what we've been discussing now is separate from that in some ways.

MEMBER PETTI: Correct.

CHAIR BALLINGER: And so, we need to be -- kind of re-center ourselves a little bit and decide how we going to proceed.

VICE CHAIR HALNON: I think 1 and 2 didn't get -- I didn't see any dissatisfaction with those. I think those would come off the list.

MEMBER PETTI: Correct. That's exactly what I was as going to say. We got the clarifications we needed, I think.

CHAIR BALLING: If I were to rank them, I would rank TBS size -- in terms of order of discussion, TBS size, FFRD, and then subsumed in that would be the clad testing that whole set of reg guides and stuff related to that. And then, you know, I'm confused a little bit or ambivalent about how to deal with the combination of 6 and 7 now, 1.183 control room dose based on what we had discussed this morning already. So I'm assuming that somebody that's a heck of a lot more knowledgeable than me will take a stab at that.

MEMBER PETTI: Yes. I'm going to do that.

CHAIR BALLINGER: So Dave's going -- you've already supplied me with a few things, but not nearly what we've been talking about so far.

MEMBER MARTIN: I can help you with that, too Dave.

MEMBER ROBERTS: Yeah, I'll help you Dave on that also.

MEMBER PETTI: I'm going to -- you know, I had a specific concern that we went through on the, you know, FFRD, DBA, LOCA, but they clarified that so I don't -- I'm not going to -- I don't think we can talk about it. It's really just going to focus on the control room dose.

CHAIR BALLINGER: Okay. So control room dose and I've got Dave, Tom, and Steve. Okay. Well, I've accomplished one thing so far.

MEMBER PETTI: Let me do this. On TBS size, I really liked some of is the words that Craig had put together. I think we want a positive comment on the strong technical basis of TBS. It's even stronger than it was, you know, when -- because it was only based on expert elicitation, right, and that seismic stuff that they did. Now they've got probabilistic fracture mechanics. So I think something, you know, a comment on that would be worthwhile. I'm not sure where we come down on the inspection stuff. We spent a lot of time talking about it. I think we all better understand it. Is there still an issue?

CHAIR BALLINGER: I am pretty sure there's an -- that's one of the issues that our industry participants suggested was an issue. When I heard from Dave Rudland compared to what I heard from the industry side, there's a disconnect somewhere, I think. A disagreement.

MEMBER HARRINGTON: Where we landed yesterday I think was, you know, better understanding by industry of the staff's intent and a need to, one, go back and think about that and, two, spend some time in workshops and table talks --

CHAIR BALLINGER: Yeah. And this is --

MEMBER HARRING: -- figuring through it. And --

CHAIR BALLINGER: -- the workshop tabletop discussion part. Yeah. I'm -- there's nothing on here that relate to see putting the actual conditions in today's plants in context. The 1.145 -- boy, I keep forgetting these things -- the last one we got talks about leak rate detection and those kinds of things and ALS puts a lot of emphasis on administrative controls and leak rate detection and things like that. And so -- and I keep harping on the fact that a lot of these welds have been mitigated in one way or another and there may be others that aren't. But some discussion to put the concurrent state of the plants in perspective with respect to the rule -- with respect to what's going to be required. Because I suspect that if you go through those tables and move, there's the short circuits through some of those tables exist because a lot of the welds that we've been talking about, or that are in this class, have very low probability of rupture. In fact, I don't want to use -- you know, he corrects me when I use the word zero, but it was his own words. His own words. But that is the -- remember this rule is going to be part of the public. So we ought to be sure that we don't -- that we put things in the right perspective in that regard. And I don't know what other people think. I don't know where that fits in here either.

MEMBER PETTI: Well, I mean, I think it has to be under TBS.

CHAIR BALLINTER: Yeah.

MEMBER PETTI: And so I'm thinking one bullet that talks about the strength of the technical basis and another that just talks about the need -- in inspection space the need to, you know, better characterize the actual state of the industry because the industry was confused, right. I mean, I think the staff has a certain idea of what the words mean, and the industry had a different idea. And so maybe it's --

VICE CHAIR HALNON: So Dave, I was going to say it sounded to me like there was -- the language in the rule was somewhat developed on the fact that there was some gaps in the knowledge of, like, what you said the present status of the industry is by the staff. There was a couple times we just don't know what we don't know. And I think that that's where the workshop will come in. If those we don't knows were itemized or if the industry could come with that information and sort of the rule language could reflect that knowledge now. So it helps what Ron is basically, what kind of mitigation has been done and what's left out there.

CHAIR BALLINGER: I think it's wrong -- it would be wrong for us to give the impression that the ASME Code is somehow wrong. Section XI is somehow inadequate, unless that's what we really think. I don't think so.

MEMBER HARRINGTON: I can help put words to part of the letter that we're talking. Maybe not so much on the ALS, but on the rules side I can.

MEMBER PETTI: Yeah. And if the answer is that we need -- you know, that they need to work this in a workshop because there's this gap -- knowledge gaps by -- and that's a fine recommendation to have them work together. I don't have a problem with that.

CHAIR BALLINGER: Okay. So I've got my -- I've got Craig and myself and anybody else that would volunteer or be voluntold. Okay. So let's go --

MEMBER PETTI: FFRD.

CHAIR BALLINGER: FFRD. I've got to take the lead on that. Unless, again, we want to voluntold somebody.

MEMBER PETTI: I think what I have -- I have a couple of things. I have I still think no burst of preferable at least in the near term until more is learned about FFRD. So there is a concern that the -- we're concerned that the analysis could be become intractable, which leads to there really needs to be more focus on the best estimate really means.

CHAIR BALLINGER: I think we're in violent agreement on that. Yeah.

MEMBER PETTI: So I was thinking Tom was the one who brought up the whole best estimate discussion that he could work with --

CHAIR BALLINGER: Yeah. And I put him on

the list for -- he needs to supply at least 50 pages.

And it's got to have cliff-edge effect and watchdog timer at least on he each page.

MEMBER PETTI: On the clad testing, you've already get written stuff from me, I think.

CHAIR BALLINGER: To me, that's part of FFRD.

MEMBER PETTI: Right.

CHAIR BALLINGER: That's part of -- yeah.

MEMBER PETTI: I see multiple bullets in the -- you know, we're going to have a header TBS, header FFRD. And we can talk about the clad testing as a separate item.

CHAIR BALLINGER: Yes. Because we wrote a letter on that. Well, we wrote a letter on the real and we wrote a letter on the old 50.46c where we actually outlined it -- with related to the issue and required testing and the like, we came down on that and I don't think we need -- unless we know we need to change our mind, we probably shouldn't be inconsistent with the letter on 46c that we wrote which is somewhere in the ether. So myself -- we're talking about an FFRD and clad testing, myself, Tom, I'll put Dave down. Who else wants to volunteer?

DR. SCHULTZ: I'll be in there too, Ron.

CHAIR BALLINGER: Okay so, Steve. Okay. Some of these folks that are out in the ether. Walt, come on.

MEMBER PETTI: He's kind of busy on NuScale.

CHAIR BALLINGER: Yeah, okay.

MEMBER KIRCHNER: I have my hands full on some other things.

CHAIR BALLINGER: Okay. I just wanted to give you a chance.

MEMBER KIRCHNER: Thank you. No. I certainly will try and assist where I can.

CHAIR BALLINGER: I have another letter to do also.

MEMBER KIRCHNER: Yes.

CHAIR BALLINGER: Yeah. 3.78 letter which is going to be simple but nonetheless it's still a letter. Let's see. We got FFRD. We got clad testing. Okay. We got the control room doses.

MEMBER PETTI: Right. We got that all done.

CHAIR BALLINGER: You know, we may have it.

MEMBER PETTI: Well, the broader impacts. Who's going to lead that?

CHAIR BALLINGER: Oh, yeah. Yeah. But I'm assuming that that was -- I got that as a higher level.

VICE CHAIR HALNON: Yeah. I don't think that we can --

CHAIR BALLINGER: That's, like, everybody right?

VICE CHAIR HALNON: -- get detailed in there. We need to give a couple of examples and what you said earlier. Just continue the thought process.

MEMBER PETTI: Sure. I'm just saying can someone draft a paragraph to put in the letter to help Ron.

MEMBER MARTIN: Tom and I could work on that.

MEMBER PETTI: Yeah. That was exactly where I was going to go.

MEMBER MARTIN: Yeah.

CHAIR BALLINGER: So now these -- the way we've got it scoped out here, that kind of helps deal with the discussion that needs to see take place on each one. And what I'm hearing -- what we -- what I'd like to hear people's comments on are other discussion topics. For example, a lot of these conclusions and recommendations stress the ongoing process that's going to happen of the workshops and things like that. Somewhere in the discussion there has to be -- we have to put something in there that unifies all of this and stresses the fact that any of this is draft rule, and they've got the workshops and, I don't know, pilot, whatever happens, are going to take place and they'll have a significant impact on the final rule. And that's something we need to endorse. Maybe that's a conclusion also, I don't know.

DR. SCHULTZ: But I think it shows up in three or four different topics.

CHAIR BALLINGER: Oh, it does. It shows up everywhere.

DR. SCHULTZ: It can wrap up to a conclusion.

MEMBER PETTI: Yeah. Instead of calling it broader impacts, I'd call it broader impacts and opportunities. That's where you could, you know, endorse this idea of the workshops as being a way to resolve a lot of these.

CHAIR BALLINGER: Yeah. You know, the paragraph begins with, as we have discussed several times before. Yes?

MR. MOORE: Chair, this is Scott Moore, acting executive director of resource. If the subcommittee on committee's going to get into how the staff approaches this, make sure you have a link to safety about how it will impact safety either positively or, if they don't do it, negatively.

CHAIR BALLINGER: Okay. Yeah. I mean, I guess it was by default that to assume that you were going to do that. But okay. So make sure link to safety. Okay. Okay. Now, Vesna, you've had comments from time to time related to control room dose and TRA discussion and the like. Is there something that you think we need to deal with, or you can provide input on?

MEMBER DIMITRIJEVIC: Well, I can review what is written about this control room dose and make sure that you're not -- that those things are captured, you know. We will be writing this letter together, right? We can contribute there. I mean, I don't think I can take lead on anything here.

MEMBER PETTI: I'll draft something, and I'll put the other people on.

CHAIR BALLINGER: Yeah it would be very, very, very, very nice if we didn't end up with letter writing from scratch on a topic during the February meeting. So that would be not nice to me.

MEMBER BIER: Yeah I will -- this is

Vicki. I will volunteer also to at least kibitz on the control room dose issue. I'm not sure I understand it well enough to have an opinion yet myself, but I'm happy to look at it and weigh in if, you know, things are headed in a good direction or whatever.

MEMBER DIMITRIJEVIC: Well, also, my thinking was also in the, you know, when it comes to the inservice inspections, and so I'm very familiar with the Section XI. For my side, I will also kibitz, as Vicki will say, on that and see where it goes.

MEMBER BIER: Please copy me on that part of it.

CHAIR BALLINGER: Please keep in mind that this is a draft rule. So if we do what amounts to getting into the weeds, we're just not going to be as productive was we could be I think.

DR. SCHULTZ: PRA also showed up in the charts that were shown yesterday.

CHAIR BALLINGER: Right. That's what tripped me active.

DR. SCHULTZ: Yeah. So might be something to examine more thoroughly.

CHAIR BALLINGER: Okay. Other comments from members? Scott, you've been strangely silent.

MEMBER PALMTAG: My concern was the control room dose. I think we're in consensus on that.

CHAIR BALLINGER: Okay. So we're good there?

MEMBER PALMTAG: Yeah.

MEMBER PETTI: Ron, I lost track of who were the people on the control room dose. I didn't write it down.

CHAIR BALLINGER: You, Tom, and Steve.

MEMBER PETTI: Good. Okay.

CHAIR BALLINGER: And I think they'll be some kibitzing from other people as well.

MEMBER PETTI: Right. Okay. Got it.

CHAIR BALLINGER: That's otherwise known as letter writing.

MEMBER PETTI: Look, this is exactly how we did Part 53. Some of the people who are -- who were not involved. When we get these really odd rules we kind of do a little divide and conquer and I think it just helps us get to a letter better and faster so.

CHAIR BALLINGER: Well, speaking of better and faster, my schedule is -- I would like to -- my significant other is out of town Monday and Tuesday this coming week. So that's going to be the time when

I'm going to start trying to at least hang things together. I've got something written on the introductory part and way down is help there too. And so there's a little bit going on there. And then I plan on coming in the week of full committee on the Monday. Our full committee doesn't start until Tuesday, and I don't think -- I don't know what the schedule is on this letter. NuScale on Tuesday.

MR. BURKHART: This is Larry Burkhart. NuScale and subcommittee meetings on Tuesday. The full committee is on Wednesday.

CHAIR BALLINGER: So are we taking this up right off the bat?

MR. BURKHART: No. I got 3.78.

CHAIR BALLINGER: Okay. That's the other one.

MR. BURKHART: 10:30 on Wednesday is this topic. One thing I would still need to do today at some point when you're ready is take public comment and discuss what's desired for that full committee by presentation by the staff industry, et cetera so.

CHAIR BALLINGER: And we kind of had to have our sort of ducks in a row here and then -- before we have that discussion.

MEMBER PETTI: So Ron, just one more thing to realize in terms of time, if you guys got on email we have to change our computers those of us of that the old black ones in February. And that's the only time. So I'm going to have to step out of the NuScale meeting to go -- hopefully it won't take long to get rid of the old computer and to get the new one.

CHAIR BALLINGER: But this is all public. So we don't have -- well, we don't necessarily need our NRC computer. So if they're in the process of getting changed out or something like that, it could not be.

MR. BURKHART: It's just an hour out of a meeting.

MEMBER PETTI: It's just an hour out of our meeting, but each of us has to do that and so it's going to -- it's something that we have to be aware of for next week. Ron, what is your availability the last week of the month, the week before full committee?

CHAIR BALLINGER: Now I got to figure out dates. Thought I had only win week to do this. Where am I missing something?

MEMBER PETTI: There's two weeks.

CHAIR BALLINGER: Two weeks. I can be available at any time.

MEMBER PETTI: Okay. I am tied up. I'm actually back in Washington for the National Academy nuclear workshop that I got roped into. So I don't have any availability.

CHAIR BALLINGER: I can be available at any time. In fact, I can -- I haven't been to Idaho in a long time. I don't want to go to Idaho in a long time. But schedule is completely open, and I can adjust to do whatever. Except I have only one engagement on February the 23rd -- on the 23rd of February, but that's after full committee. So I'm good.

MEMBER PETTI: I'm Tuesday through Friday the week before our full committee I'm in D.C., online, and airplane.

CHAIR BALLINGER: Well, if we're not well along by the week before full committee, we're in Dutch.

MEMBER PETTI: Right. Okay.

CHAIR BALLINGER: Okay. So now you've announced that I have no life but --

MEMBER DIMITRIJEVIC: Ron?

CHAIR BALLINGER: Yeah.

MEMBER DIMITRIJEVIC: Maybe you can have these list with the people who are doing it in charge.

You know, so we have some comments we can send to them.

CHAIR BALLINGER: Yeah. I think, if I were to get comments or write-ups or whatever it happens to be, what I would think about doing is having Teams meetings with these groups when appropriate. I don't know if we can. My next question to Larry was, can I do that?

MR. BURKHART: Restate the question, please? I'm sorry.

CHAIR BALLINGER: Well, we've got these groups on these areas and we're working on write-ups and stuff. Can we have virtual meetings amongst these groups? Not everybody. But just these groups they have discussions.

MR. BURKHART: So we should discuss that. I mean, to be clear, what you're doing now and what you're doing in these other meetings that you talk about preparatory work, right?

CHAIR BALLINGER: Right.

MR. BURKHART: Deliberation -- true deliberation will happen during full committee meeting in February. So there should not be substantive of exchanges of ideas without that being --

CHAIR BALLINGER: In other words, no.

MR. BURKHART: You can exchange drafts of what you've written up that will be discussed at the full committee meeting and deliberated on in full committee meeting. You should not have sustained discussion between yourselves outside of a publicly announced meeting unless it's proprietary.

VICE CHAIR HALNON: We're stepping real close to the line that we shouldn't be close to.

MR. BURKHART: Yes. Exactly.

VICE CHAIR HALNON: Those kinds of meetings would need to be subcommittee meetings.

CHAIR BALLINGER: All right.

MEMBER PETTI: That's why I tend to think that it should be the lead member that we've assigned should take the best cut. And I think they're allowed to email that the others.

CHAIR BALLINGER: Okay. So, Dave, you're the lead on Number 1 which is the control room dose. The rest the committee is Tom and Steve. The TBS size I've got Craig listed as Number 1, so by definition you must be the lead. And then I'll be the lead on both FFRD and the clad testing with Tom, Dave, and Steve. Okay. So now the lead can get obviously input from others and then produce a draft document, if you will, and then we can circulate that. We're not over-stepping our lane there, right?

MR. MOORE: So I think -- this is Scott Moore. I think that it's reasonable for the lead to interact with the other people that are assigned on that topic to develop something. As soon as sections start going out to everybody, they cannot tender discussion.

CHAIR BALLINGER: Yeah. What you just told me then we could do it by -- if the lead can have interactions with the other members, why can't we do that virtually?

MR. MOORE: The few other members.

CHAIR BALLINGER: Yeah. Yeah.

MR. MOORE: That's something that can go on that you don't want to have discussions. Basically you don't want to trip into deliberation.

MEMBER PETTI: I think if you just do it by email you're safer.

CHAIR BALLINGER: Safer. All right. Okay.

MEMBER PETTI: And who's leading the broader impact?

CHAIR BALLINGER: There is nobody assigned for that yet. I thought that was more or less -- well, no, no. I think Craig.

MEMBER HARRINGTON: Yeah. I'm going to -- I'll take the first cut, and Tom will write a lot more detail I'm sure. Because mine is going to be really focused on control room and impacts to the operator. You're going to probably be more of a design space. So that's --

MEMBER PETTI: It's good. That'll be good.

MEMBER HARRINGTON: I'll write the first paragraph, and I am sure Tom's going to add another one to it.

MEMBER ROBERTS: I plan to focus on the role of the PRA in the severe accident and evaluating the impact of things allowed by design changes.

MEMBER HARRINGTON: I think it's going to be a few sentences with a couple examples.

MEMBER ROBERTS: I agree.

MEMBER PETTI: Exactly.

MEMBER PALMTAG: What about these other options in ALS? Where would that go?

CHAIR BALLINGER: Well, I'm guessing that these options somewhere get discussed -- well, ALS is primarily FFRD related, so that's where it would be here.

MEMBER HARRINGTON: I would be inclined

for us to focus the letter on the rule and then have another paragraph or two that talks about the other options and how they fit into --

CHAIR BALLINGER: That -- yeah.

MEMBER HARRINGTON: -- the overall landscape.

CHAIR BALLINGER: Dave suggested that -- the oh, by the way paragraph, which is the one that we're talking about, would be after the broader impacts, you know, as part of that general thing. Did I get that right, Dave?

MEMBER PETTI: Yeah.

CHAIR BALLINGER: So that's where that would go.

MEMBER HARRINGTON: Otherwise, I think the letter gets really convoluted in, you know, what it's talking about.

CHAIR BALLINGER: Oh sure. Yeah. Yeah. So let's see. Who wants to -- well, it looks like I'm the only one that read that NEI letter.

MEMBER PETTI: I've read it.

CHAIR BALLINGER: You read it? Yeah. So what about you and I, Dave, do that? I'm happy to do it also because, you know, I spent last evening going through things. And I think I understand -- you know, I listened to the presentations yesterday and that prompted me to go after that letter and read it thoroughly. And I think I understand better what I already thought about Option 5 from the earlier readings of the rule. So I can put together.

DR. SCHULTZ: I can work with you, Ron. I think -- I know I have some NuScale stuff. I don't want to make Walt nervous, but I can work with you on that.

CHAIR BALLINGER: Okay. So -- I just use word ALS but it's broader than that.

DR. SCHULTZ: Sure. But that's going to work right into the workshops as well and industry interaction.

CHAIR BALLINGER: Oh, yeah. I'm guessing that the first workshop will be a discussion of that letter, topics of the letter the way they interact.

MEMBER PALMTAG: One thing with these other options, I'm kind of -- one hand I'm a little bit concerned that we seem to be ignoring the BWRs, but on the other hand, I don't really hear anything that they need anything either.

CHAIR BALLINGER: Yeah. We had some of these side discussions yesterday. They're already on a 24-month cycle.

MEMBER PALMTAG: Right. So I don't know if we should at least mention BWR. There's not really a path forward for BWRs here, but I don't know.

CHAIR BALLINGER: An Option 4 presumably is the path forward for BWRs, right.

MEMBER PALMTAG: Is that -- I don't know. I haven't heard anything about that so --

CHAIR BALLINGER: There was some discussion -- now its fuzzy -- yesterday.

MEMBER PALMTAG: NEI was pushing for it

CHAIR BALLINGER: Yes. Yes.

MEMBER PALMTAG: But I haven't heard any progress on it or anything. The NEI's original proposal was for modifying 5 and then they didn't they there was time for 2.

DR. SCHULTZ: It seems to still be somewhat conceptual in space.

MEMBER PALMTAG: Yeah. That's my understanding too.

CHAIR BALLINGER: Again, we know -- we think we know what the industry is favoring, but it's our letter.

MEMBER PALMTAG: Right. I'm just -- I would like -- I think we need to mention that this is very BWR specific. I just don't know if needs to be for BWRs or not.

CHAIR BALLINGER: Okay. That would probably be in the introduction related to background or whatever.

MEMBER PALMTAG: I'll let you -- we have a comment.

MR. RUDLAND: This is Dave Rudland from the staff. I'm still -- I am sure why the committee keeps saying there's no path to BWRs. I don't --

MEMBER PALMTAG: What is the path I guess?

MR. RUDLAND: Well, again at least for the TBS there's a path. There just is not -- they don't have an LBB analysis so they still -- they all have to do some kind of analyses to demonstrate that and that's one of the paths in the flow chart that we showed. So there is not no path. It just may not be a path that they want to take. But there still is a path.

CHAIR BALLINGER: The BWRs are not likely to call you to satisfy leaving for a break. They're going to call the chemistry people and they're going make an argument.

MR. RUDLAND: There going to call EPRI or somebody like that. But I don't think saying that there's no path is --

DR. SCHULTZ: I was going to say --

MR. RUDLAND: I thought I heard --

MEMBER PALMTAG: That might be a little strong. There's not a --

MR. RUDLAND: There's not an easy button.

MEMBER PALMTAG: -- easy straight forward path.

MR. RUDLAND: Yeah. There's not the same easy button as the PWRs have, but there's still a path for them. That was a TBS applicability.

MEMBER HARRINGTON: Make I can take up that theme at least in a little bit in the TBS discussion for the letter. So at least point out that there are differences. It's not no path, but it may be a more challenging path.

CHAIR BALLINGER: But we did have a discussion with the one of the industry folks -- I think it's an industry.

MS. CLARK: Baris is on the line from the BWROG.

MR. LI: This is Guangjun Li from GEH. The other paths, so right now based on the rule -- based on what we read actually only the dispersal is allowed above the TBS. Below the TBS there are no perforations (phonetic) allowed. This list alone probably have a big problem with BWR. BWR, the 50 percent is a small break limit. Even for the large break limit itself you could have a perforation as a break below TBS. TBS, therefore -- determining TBS is very hard for BWR. You have to deal with all of the leak before break, all of this stuff. I mean, yeah, you could say you have a way but that way probably too hard for the licensee to overcome. Fifty percent, I mean, if you don't allow the perforation below the TBS, yes, without that, we have big problems.

MEMBER PALMTAG: I guess my question is more big picture, is there something we're missing that the BWRs really need or want or are you just observing this?

MR. LI: I don't know, there is an assumption basically in the NRC document saying FFRD actually large break is always limiting because pressure is down fast, and you have (indiscernible due to accent). But there's other things, I mean, the combination you have the chromium (phonetic) temperature stuff. So actually (indiscernible due to accent) could be, we found preliminary, yeah we have those perforation. So that's something I think we have this modified Option 4. So basically from the consequences point of view, you consider the dose that is basically eventually you're clear for the (indiscernible due to accent).

MEMBER PALMTAG: So what I'm hearing is the BWRs want this Option 4?

MR. LI: Yes. Thank you.

MS. GERKEN: This is Lisa Gerken from Framatome with both BWR and PWRs. So this -- I think it comes back to how perhaps the Draft Guide is written. Some of the conversation we had earlier about just saying that the way to address fuel dispersal is by saying no cladding rupture. If you eliminate that then it opens up a lot more space to say, if cladding rupture is your only way then whatever plant you are, for whatever break size you have, you have some path forward to be able to justify what the effects of dispersal are, why dispersal is not an issue. But I think it's coming back to the way that 1434 is written right now, where it's only saying that you can do something the besides cladding rupture or above the design base if you're above the TBS. So basically you can only have fuel dispersal for beyond that basis. To come back to alternative 4, alternative 4 doesn't specify DBA versus BDBA, it's just saying there is a consequence, and plants must deal with it in some manner. So I think removing the limitation to cladding rupture is hugely helpful for our BWR fleet and as well as Theresa had said earlier, their flexibility in multiple strategies whether it be alternative 4 if it's codified, whether it be ALS, whether it be XY or Z. Strategy flexibility, I think, is the key thing that we need from the NRC right now for fuel dispersal or for whatever comes down two years from now. There will be something else, and we need to be acceptable to different strategies for how plants operate.

MR. MESSINA: Joe Messina. Just wanted to clarify. The guide is guidance. One way to meet the regulation. And also, I'm not sure maybe I misspoke or misimplied, but for breaks below the transition break size, dispersal could happen if it could analyze it under the high probability assumptions or find another way to address it. It's just the guide only really addresses dispersal above the transition break size. And below the transition break size says the main way is to show no burst of the rod is susceptible to that part.

CHAIR BALLINGER: Thank you. You said that two or three times yesterday so --

MR. MESSINA: Just -- clear.

MR. CSONTOS: So this is Al Csontos. I

don't want to reiterate. Baris Sarikaya is on and he's the PWR, VIP -- I'm sorry, PWR owners group representative to the group that we have here. And so he can respond. I think the other thing I just want to add in is the implementability, if that's a word, you know, going forward, is that PWRs like they said have an easier path. But it's not just an easy button, it's like what can we get done understanding the risk of LOCA. And so what is a risk-informed approach to get to an appropriate answer on the assurance and safety for BWR and you know, have hopefully a similar timeframe as these, knowing that leak before break will get through between now and then. So and that's why we were saying Option 4 may be another option for us to pursue. So I'll let Baris, can you -- I saw your hand up.

MR. SARIKAYA: Yeah. Thanks, Al. And, again, in the interest of not repeating everything that's been done -- said, I do agree that BWRs -- the path for BWRs currently is not as clear as the PWRs. And that causes us concern for our submittals because we do not know what type of additional challenges we will see in that paths that we don't know how we get there or the more difficult path. The other thing that I want to mention is that we keep talking about

TBS below and above and Guangjun mentioned that. That our half the BWR fleet is small or intermediate break level. So just focusing on about TBS for one solution that is not -- that does not sound technology-neutral. And then the last thing I want to add is that we had a really great discussion early in the morning about the unintended consequences. One thing that I'd like to bring the members' attention is that we need to also think about what is the unintended consequence of adding excess conservatism to regulation? Does that have -- does that make us to do -- go change things in the plant operation? Does that increase the dose to the average workers? Are we trading the imaginary dose with the real dose? I think when we have the discussion about the unintended consequences, we're going to need to think about the real life affect as well. Thank you.

CHAIR BALLINGER: Okay.

MR. TREGONING: Maybe one more? This is Rob.

VICE CHAIR HALNON: Yeah, one more, Rob.

MR. TREGONING: I just want to comment on the BWR path through this. LBB is one way, but there are other ways. There's an Option 3 analysis where they just have to look at critical areas. So it would be a very simplified analysis. And we've never granted an LBB for BWR. And while that's not part of the rule, there may be other benefits that the BWR community could glean from LBB. And so that's something that could be outside the framework of this rule, but it might be something that's worth pursuing. So two things. There is an alternative path for BWRs that does not require, that's an LBB evaluation. However, if they do decide to do an LBB evaluation, there may be other operational benefits that they may gain from that evaluation. So that's all I want to say.

CHAIR BALLINGER: Thank you. Okay. I think we're pretty much exhausting our discussion. So if that's the case, then I think we need to go out for public comments. And --

MEMBER KIRCHNER: Ron, pardon me. We don't need to go out for public comment. We did that yesterday. These are committee deliberations, and we don't take public comment on committee deliberations.

CHAIR BALLINGER: Okay. I was just looking over at the control desk and people were saying yes so. Okay. We don't need to do it, we don't need to do it.

MR. MOORE: This is Scott Moore. I do

believe that it's in the agenda.

CHAIR BALLINGER: Well, that may be true.

MR. KIRCHNER: If there is a second opportunity for public comment, then go ahead and do it. But typically we don't do it on committee deliberations.

CHAIR BALLINGER: Okay. There is a public comment opportunity. It's later in the day today, but I think we're not going to make it that far.

VICE CHAIR HALNON: Well, in charity this is not a deliberation. That happens during full committee meeting, and this is subcommittee discussion, which I think may be different. I don't know if there's a nuance there.

MR. KIRCHNER: Yeah. I misspoke. Yeah. It's the subcommittee making a recommendation to the full committee. But we typically don't take comments on our recommendations. We have allowed adequate input by even entertaining input today from the non-members that are present. But go ahead. If you -- if that checks the box, go ahead and take comments from the public.

MEMBER HARRINGTON: Ron, before we do that there's one other person to follow up on what Scott was poking at earlier. In big view of our space, is there -- right now, in PWR space there's somewhat compelling timeline that that plants are working to to try to move forward on increased enrichment issues. Is there something similar to that in BWR space?

MR. LI: Yes. It's Guangjun Li from GEH. Yes, there is several plants like we've had like (indiscernible due to accent) and also Constellation has an interest on this.

MEMBER HARRINGTON: And it's (audio interference) or --

MR. LI: Well, we just want to extend the (indiscernible due to accent).

MEMBER HARRINGTON: Okay.

MEMBER ROBERTS: So it's a burnup increase?

MR. LI: Yes.

MEMBER ROBERTS: Thank you.

DR. SCHULTZ: We had some discussions at various times about best estimate LOCA and what was the definition of that for the work that's being done associated with this, if any. Is that still a topic that reaches? I mean, we never came to any conclusion there. Just --

PARTICIPANT: Just caught up in either FFRD or TBA.

CHAIR BALLINGER: Yeah. That's what I was saying.

MEMBER PETTI: It is FFRD.

PARTICIPANT: Good.

CHAIR BALLINGER: Okay. Again, I think we should go out for public comments. If there are members of the public that would like to make a comment, please state your name and your organization if you choose and make your comment. I don't see anybody but that's -- who knows.

MEMBER MARTIN: Do what you did yesterday and just invite anybody without raising their hand.

CHAIR BALLINGER: Well, we had one person that didn't raise his hand and then got us at the end. But I think we're fine. So okay. No. We have -- hearing no public comments, unless there are additional things that we need to discuss.

MR. BURKHART: So you need to talk about what is the --

(Simultaneous speaking.)

CHAIR BALLINGER: Oh, yeah. Yeah. Yeah. Okay. So now that we have this grouping that we have, and we had discussions of each one of these things, pretty extensive, where would we like to see the staff being -- making a discussion? I mean, I'm going to guess that control room dose and 1.183 is 1. The TBS size we need to have some presentations related to that, and FFRD the clad testing. Those are the areas that we've identified. I don't think, you know, broader impacts or ALS or anything like that needs to be there. Unless I don't know what the rules are on public participation by request to make presentations.

VICE CHAIR HALNON: I have a suggestion and that is to, since this is subcommittee and full committee theoretically has different -- you know, for a broader audience even though we're all here, we can take -- and this kind of speaks to the how does it all fit together. Take each major section -- some of these are on here, like, FFRD, control room dose, and just do one- or two-bullet summary of what that is and what it does and just walk through four or five slides of the huge in a very broad overview of the rule. That will spark discussions based on what we're writing in the smaller groups. And that, again, will help the full aspect of how it all fits together in the bigger picture.

CHAIR BALLINGER: Just stick to the main points.

VICE CHAIR HALNON: Yeah. Just --

CHAIR BALLINGER: How much time is there

on the agenda?

VICE CHAIR HALNON: Control room dose, here's two bullets. FFRD, three bullets. You know, just something very high level. If nothing else -- if you're not going to be able to queue up every little technical issue that has been discussed, but if you can queue up the topic and any of the members who have been thinking about it, writing words down, considering transcripts and other things we've done, if it's still burning in them, they'll don't bring it up. They'll bring up a topic under it. And we can talk about that specific topic as opposed to a very broad discussion.

CHAIR BALLINGER: And you've heard all of the discussions, so you pretty much know.

VICE CHAIR HALNON: Does that seem reasonable? Does it resonate that you can do that in maybe, you know, 45 minutes to an hour?

CHAIR BALLINGER: Is that what we have?

MR. BURKHART: Yeah. So on February full committee agenda on March 5th, we have 10:30 to 1:00. Essentially we have an hour and a half, 2 hours for presentation.

CHAIR BALLINGER: We have until 5:00.

MR. BURKHART: We have the complete rest

of the day for committee deliberations on the subject. So it's a lot of time in the full committee meeting, so yes. So I think you're getting to what you want from the staff. The question is in my mind, do you want anything from the industry? There had been -- with that in mind, there had been a lot of subcommittee meetings that are documenting all this stuff. So I think that is a reason why you may not need as much from the staff and the industry in the full committee. That's up to the committee.

VICE CHAIR HALNON: If we're going to have an industry folk, I'd have Al come up speaking for the wider industry and here's, again, take their two or three letters that they sent and just give me two -- one bullet on each of the main points and where we want to see and what we want for, you know, not platitude, but what we need to see more and more for. If we're still in disagreement here, a workshop will help. That will help us correlate where when we say we're encouraging the workshops moving forward, that'll help us correlate where those need to be. And the prep work into those workshops is highly important so that workshop is useful to the industry. Because there's a lot of investment into these workshops. It's not just a bunch of people getting together.

There's typically just tremendous amount of work and cost for these workshops. So we want to make sure that we encourage them that we're not just asking to check a box at the end of the workshop. So, Al, does that seem reasonable that you could just come in for maybe 15 or 20 minutes and just give us, not detailed discussions, but here are the high points and where the industry's head's at?

MR. CSONTOS: Sure. This is Al Csontos, NEI. Yes, we can do that. We can probably give you a prioritized list of the issues in terms of priority to the industry. So probably through a workshop.

VICE CHAIR HALNON: That would be useful, I think. Maybe 15 minutes?

MR. CSONTOS: Sure.

VICE CHAIR HALNON: Okay.

MR. BURKHART: Sure. And just so it's -- this is Larry Burkhart, you may provide written comments the committee also. Please send that to me and wait online. We will make sure they get recorded as appropriate.

VICE CHAIR HALNON: So did she you say there are 2 hours for presentations?

MR. BURKHART: Essentially, yes.

VICE CHAIR HALNON: Okay. So an hour and

15 minutes for industry. That will give us 45 minutes of questions, which seems reasonable to me. Bob, did you have something or Dennis?

MEMBER KIRCHNER: I was going to say, yeah, that the staff does a high level overview of the rule. And as Craig said, you know, the focus really should be the rule. And our letters should focus accordingly. I mean that's what the commission as our audience and customer is going to be looking for.

VICE CHAIR HALNON: Seem reasonable, Ron?

CHAIR BALLINGER: Hmm?

VICE CHAIR HALNON: That seem reasonable?

CHAIR BALLINGER: Yeah.

VICE CHAIR HALNON: Okay. Dennis has his hand up.

CHAIR BALLINGER: Dennis?

DR. BLEY: Yeah. Ron, hadn't come after me. I have a couple -- a suggestion. There's only two areas where I think I could really help. The one you've not get pretty well covered which was in control room dose. But the thing that kind of has been nagging at me and I haven't thought it through yet, I was thinking of polyester, they're talking about forward fitting. If we apply this sliding scale in the way it's suggested, I wonder where that leads us in the future, if the staff and the commission have thought about that. As far as the meeting -- full committee meeting, staff floated this true best estimate wording and if they want to, that might be a good thing for them to expand on and be a little more specific, if they can. That's the other area I thought I could help with, if you would like. And this has nothing to do with the letter, I don't think. And I don't know what to do about it. But I was really struck on what the last month by Elijah's really great history and if somehow the committee could urge the staff to get that embedded in some permanent form. I just, that would be great. That's all.

MEMBER KIRCHNER: Dennis, that's a good point. That could perhaps be part of the knowledge management series.

CHAIR BALLINGER: Okay. Other last parting shots?

MEMBER KIRCHNER: Ron, I have one. For the people working on control room dose, I really commend you to -- first as Dennis pointed out, a larger summary of his excellent from our December presentation. It would help, I think, for to you read -- this is going to sound boring -- but 50.34 as contents of applications and Title 1034, and the footnotes there are important because they explain what an MHA is. And then there are some interesting footnote on the 25 rem question, as background. And then go look at GDC-19. And the interesting thing I would point out is that GDC-19 uses loss of coolant accidents. And so there is an opportunity -- I'll go back. I think Elijah pointed out that in the December presentation there is -- they're suggesting a rewrite for the GDC. But I just recommend that people working on this read that first to see the context in the background in the disconnect that's there between an MHA and the LOCA, and the possibility that out there to redefine that control room dose. End of comment.

CHAIR BALLINGER: Thanks. Not to give Elijah a big head, but that rule preamble that discussion of dose and the like is like a textbook. It's great.

MR. DICKSON: Thank you.

CHAIR BALLINGER: Okay. I didn't see any swelling.

MEMBER ROBERTS: Just to add to that, Walt, the other piece of that puzzle that Elijah has also done a great job putting together is probably worth clarifying and memorializing somewhere is the reason why the containment leakage assumption is apparently inconsistent with the casualty progression. The act the progression would have contained leakage in general, but there is history dating back to 1968. And then Elijah's found some references of pre-loss claim, you know, how they got decoupled and then the -- and the reason why the containment assumed to be intact even though the accident scenario wouldn't necessarily support that assumption. So it's important to understand how it all fits together because it is explains the role of why these requirements at least made sense at the time and what their current applications, you know, still means.

CHAIR BALLINGER: Okay. Again, if I keep silent somebody else will -- we can rapidly approaching faculty member -- faculty meeting issues. Apart from Elijah, again, I said it yesterday, we need to complement the staff in general on -- it's almost intractable problem that they have to deal with in an intractable amount of time. And so that's what we're doing. So and like Theresa, would you like to make any comments before we shut this down?

MS. CLARK: You just appreciate the conversation. We look forward to continuing that.

VICE CHAIR HALNON: Yeah. And let's not

forget the commitment by the industry folks to be here in person, but also obviously engage in a level of detail that is necessary.

PARTICIPANT: Very helpful.

CHAIR BALLINGER: By the way, it's not just this meeting. We've had several subcommittee presentations by industry related analysts, and Larry's alluded to the multiple subcommittees that we've had. I don't know what the count is, but it's large. Okay. That being said, unless and one more last chance for comments from members. Hearing none we're adjourned.

(Whereupon, the above-entitled matter went off the record at 10:37 a.m.)

Proposed Rule: Increased Enrichment of Conventional and Accident Tolerant Fuel Designs for Light-Water Reactors

January 16-17, 2025

Opening Remarks

Theresa Clark
Director
Division of Safety Systems

Draft Regulatory Guide DG-1428

(Proposed Regulatory Guide RG 1.258, Rev. 0)

Plant-Specific Applicability of the Transition Break Size

Presented by:

David Rudland (NRR/DNRL),
Robert Tregoning (RES/DE), and
Se-Kwon Jung (NRR/DEX)

ACRS Regulatory Rulemaking, Policies and Practices Subcommittee
January 16, 2025

Background

- Technical Basis for Transition Break Size (TBS)
  - **NUREG-1829**: Used 10^{-5}/yr conservative LOCA frequency results as starting point
  - Selected based on operating experience, piping geometries, and to promote regulatory stability
  - **NUREG-1903**: Verified that risk associated with seismic-induced breaks > TBS is acceptable
- NUREG-1829
  - Generic evaluation intended to provide best estimate LOCA frequencies accounting for uncertainty and variability
  - Only broad differences among reactor types and vendors considered
- NUREG-1903
  - **Direct piping failure**: Subset of PWRs analyzed using available information
  - **Indirect piping failure**: Scoping study of main loop piping support failure which partially updated mid-1980s estimates for two PWRs
  - Both directs and indirect failures likely have a mean failure probability on the order of 10^{-6}/yr or less, but both analyses are strongly plant specific

Initial Motivation for Regulatory Guidance

- Plant-specific attributes can strongly influence LOCA frequencies so important to ensure TBS is applicable at each plant
- Commission Direction in SRM-SECY-07-0082 (ML072220595)
  - "The final rule should require licensees to justify that the generic results in the revised NUREG-1829, 'Estimating Loss-of-Coolant Accident Frequencies Through the Elicitation Process,' are applicable to their individual plants."
  - "The staff should develop regulatory guidance that will provide a method for establishing this justification."
- Staff has interpreted that this guidance extends to NUREG-1903
- Staff developed DG-1216, "Plant-Specific Applicability of Transition Break Size Specified in 10 CFR 50.46a" (ML100430356)

DG-1216 Scope and History

- Scope
  - Only applies to primary loop piping (PLP) systems and reactor coolant pressure boundary (RCPB) components whose failure could result in breaks greater than the TBS
  - Initial NUREG-1829 Applicability
  - Initial NUREG-1903 Applicability for direct piping failures
  - Effect of plant changes on NUREG-1829 and 1903 Applicability
- History
  - Initial public meeting discussing DG white paper (ML090350757) – February 20, 2009
  - Issued for public comment (75 FR 36698) - June 28, 2010
  - ACRS Subcommittee meeting on Regulatory Policies and Practices – September 22, 2010
  - Public meeting – September 30, 2010
  - ACRS Main Committee meeting – October 7, 2010
  - End of public comment period – November 25, 2010
  - Scheduled Commission Briefing – March 24, 2011
  - DG-1216 withdrawn (81 FR 88615) – December 8, 2016

DG-1216 ACRS Feedback

- ACRS Letter on draft final 10 CFR 50.46a rule (October 20, 2010): ML102850279
  - Provides acceptable methods and acceptance criteria for evaluating NUREG-1829 applicability
  - Provides an evaluation framework and acceptance criteria to demonstrate the NUREG-1903 applicability for direct piping failures
  - Should include assessment of NUREG-1903 applicability for indirect piping failures
  - Should explore methods to reduce required effort

- Staff adopted ACRS recommendation to add guidance pertaining to indirect piping failures
  - Modified the FRN in draft final rule to require this demonstration
  - Presented initial ideas for DG-1216 modifications - September 30, 2010 public meeting
  - Planned to evaluate acceptability of planned guidance as part of pilot study

DG-1216 Public Feedback

- NEI Comments (ML103160267)
  - Guidance too complex and proposed simple checklist
  - Concerned about expanding DG-1216 to account for seismically induced indirect piping failures
  - Place more reliance on existing programs (e.g., 50.59) to reduce plant change analysis
  - Leverage existing TBS margin to provide confidence that it applies to all plants
  - Conduct a pilot study of the process prior to issuance
- PWROG Comments (ML103140567)
  - 20 specific comments; several echoed the NEI comments
  - Current inspections and examinations provide adequate protection against a large LOCA
  - Recognized reduced complexity for plants completing license renewal but concerned about burden for other plants
  - Plants in low seismic zones can be eliminated from demonstrating NUREG-1903 applicability
  - Unclear requirements or acceptance criteria associated with several regulatory positions

DG-1216: Planned Next Steps

- Wait until Commission vote on SECY-10-0161 (draft final rule) before proceeding further
- Planned activities
  - Add method to address indirect seismic analysis
  - Conduct pilot plant study
    - Evaluate guidance
    - Estimate implementation costs
    - Develop evaluation template
    - Establish change process for determining impact of future plant modifications
  - Address public comments
  - Modify guidance
  - Present draft final guidance to ACRS
- However, as stated earlier, in 2012, the Commission approved the staff's request to discontinue rulemaking (SRM-SECY-10-0161) and DG-1216 was withdrawn in 2016

Increased Enrichment Rulemaking

- In 2021, staff requested to pursue rulemaking and develop a regulatory basis to amend requirements for the use of light water reactor fuel containing uranium enriched to greater than 5.0 weight percent uranium-235
- Commission approved via SRM-SECY-21-0109, but stated Fuel Fragmentation, Relocation, and Dispersal (FFRD) should be appropriately addressed
- Staff's regulatory basis included five options for FFRD, and based on industry feedback the staff chose Alternative 2 began development of a proposed rule to implement this alternative, 10 CFR 50.46a
- This effort was described in detail at the December 2024 ACRS subcommittee meeting
- To support this proposed rule, the staff developed DG-1428, "Plant-Specific Applicability of the Transition Break Size" (ML24341A159, ACRS version)

Related Proposed Rule Requirements[1] Supported by DG-1428

- Application: 50.46a(c)
  - Existing plants: demonstrate applicability of TBS
  - New plants
    - Demonstrate similarity of plant design to existing plants
    - Recommend and justify plant-specific TBS
  - Both existing and new plants
    - Demonstrate that TBS remains applicable after initially proposed plant changes
    - Demonstrate acceptable leak detection program [Section (d)]
    - **Optional:** Describe process for demonstrating TBS applicability for changes without prior NRC approval
- Programmatic: 50.46a(d)
  - Identify, monitor, and quantify primary pressure boundary leakage
  - Perform evaluation to demonstrate that the TBS remains applicable after planned facility changes
- Changes to facility: 50.46a(h)
  - Proposed changes enacted with or without prior NRC approval demonstrate continued applicability of TBS
- Reporting (every 24 months): 50.46a(j)
  - Document basis for determining that changes enacted without prior NRC approval do not invalidate the TBS

[1] 1/16/25 – 1/17/25 – Predecisional Information to Support – ACRS Public Meeting – Draft Federal Register Notice to Support Increased Enrichment of Conventional and Accident Tolerant Fuel Designs for Light-Water Reactors (ML25013A080)

Purpose of DG-1428

- Proposed 10 CFR 50.46a requires an evaluation to demonstrate plant-specific applicability of the TBS
- This draft guide provides one acceptable way to meet that regulation
- If applicability can not be demonstrated, the entity needs to determine a plant-specific TBS. This draft guide may also aid in the development of that TBS.

DG-1428 Overview

- Used DG-1216 as the starting point for development
- Leverages required inspections and license renewal lessons-learned to streamline and simplify guidance
- Considers DG-1216 comments
- Provides guidance to address indirect seismic failures
  - Address recommendation in 2010 ACRS letter on draft final 10 CFR 50.46a rule
  - Consistent with rulemaking requirements and leverages DG-1426[2] guidance
  - Separate evaluation for NUREG-1903 applicability not necessary
- Provides several options to demonstrate TBS applicability for maximum flexibility
  - Plan to work with stakeholders to identify most viable options and further refine before finalizing
  - Propose to pilot the guidance before finalizing

[2] DG-1426, "An Approach For A Risk Informed Evaluation Process Supporting Alternative Acceptance Criteria For Emergency Core Cooling Systems For Light Water Reactors," - ACRS Version Rev 1 (ML25010A417)

DG-1428 Overview

NUREG-1829 applicability

- Aging Management
- Adequate Leak Detection
- Plant-Specific Attributes

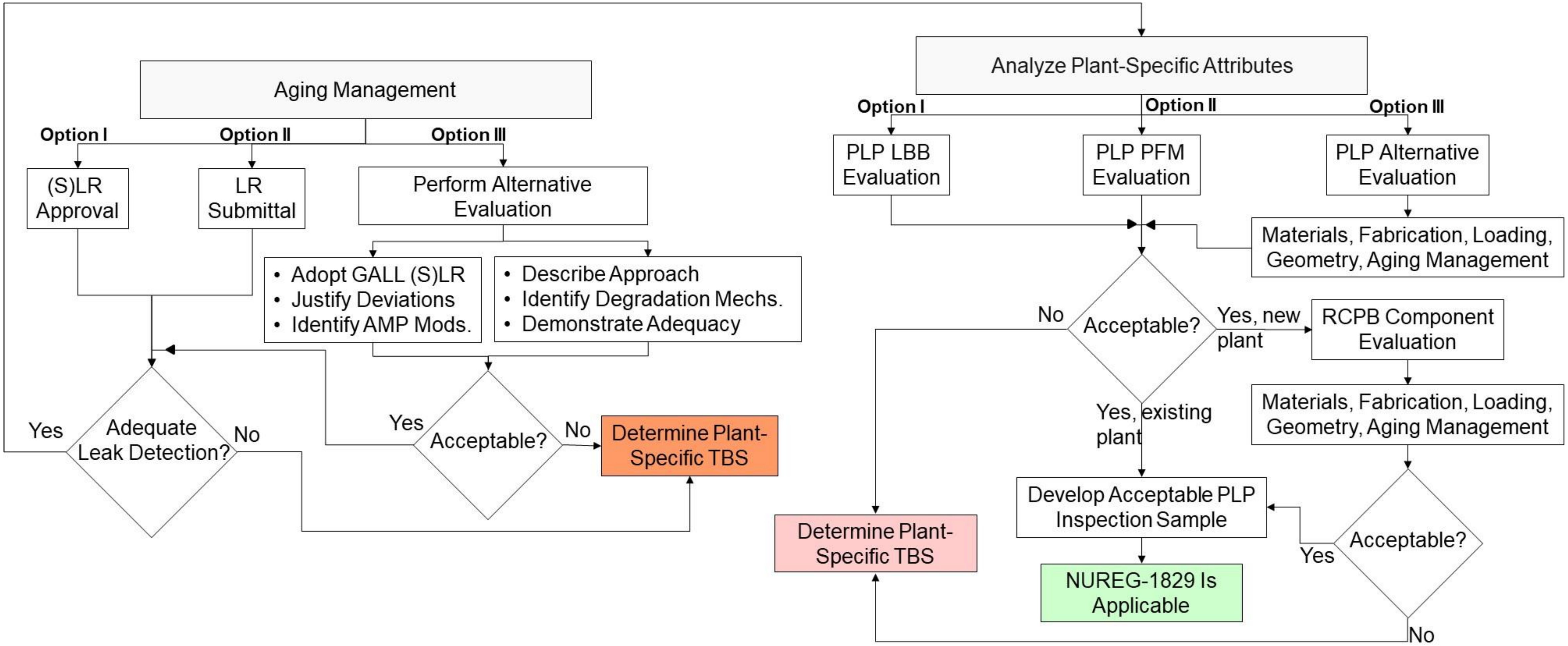
NUREG-1903 applicability

- Limiting Locations Selection
- Material Properties
- Applicability Though ISI Program
- Surface Flaw Analysis
- Component Stresses
- Seismic Risk of Indirect Failures

Plant changes and LOCA frequencies

- Direct Failures
- Indirect Failures

NUREG-1829 Applicability – General Approach



NUREG-1829 Applicability

Aging Management	**Option I**: Credit license renewal (LR) or subsequent license renewal (SLR) approval **Option II**: If first LR submitted, adopt relevant aging management programs **Option III**: Demonstrate that Part 54 requirements met for applicable PLP and RCPB components
Adequate Leak Detection	**Option I**: Demonstrate adherence to RG 1.45, "Guidance on Monitoring and Responding to Reactor Coolant System Leakage" **Option II**: Demonstrate compliance with GDC 30 and 10 CFR 50.46a(d)(2) criteria
Plant-Specific Attributes	1. Ensure PLP attributes are acceptable 2. Conduct RCPB component evaluation (new plants only) 3. Develop acceptable risk-informed PLP inspection sample

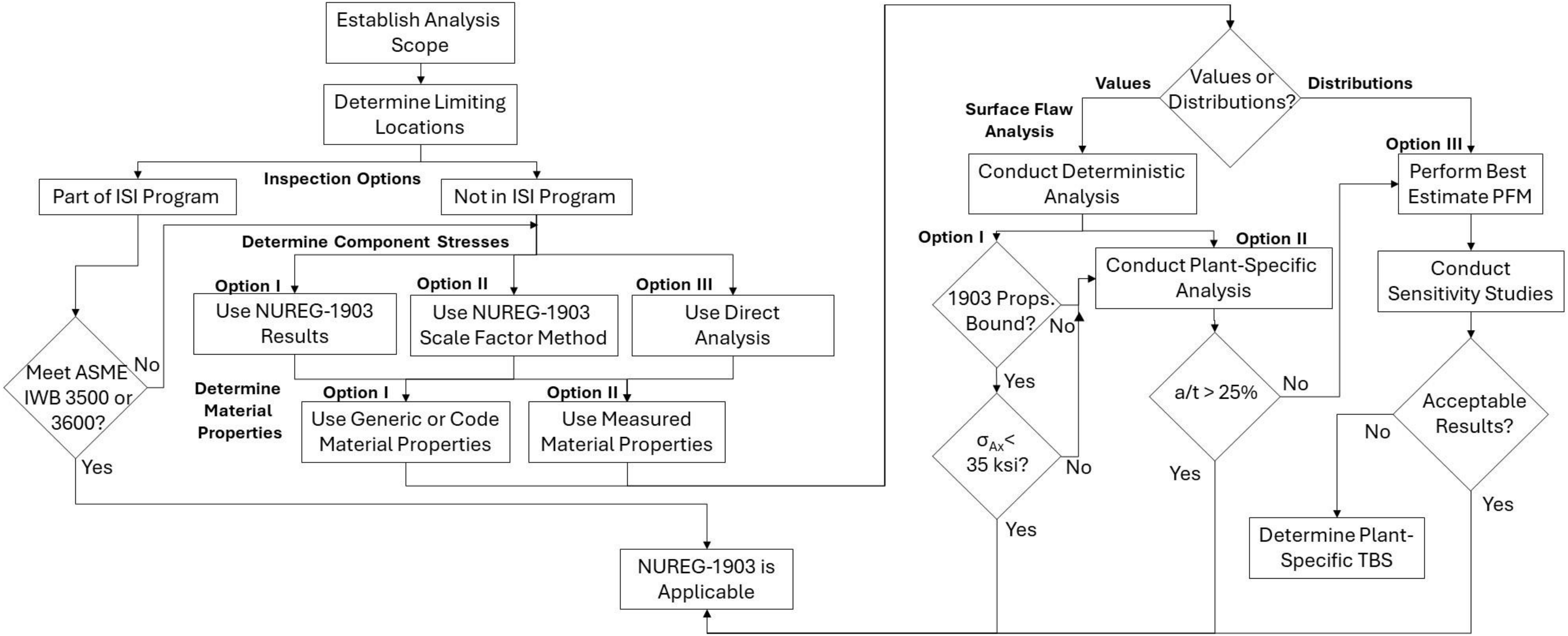
Plant-Specific Attribute Analysis

PLP Attribute Evaluation	**Option I**: Credit existing or conduct new LBB evaluations **Option II**: Conduct PFM evaluation **Option III**: Identify unique attributes* *materials; fabrication practices; loading sources, frequencies, and magnitudes; geometries and system configurations; material and component degradation; aging management
RCPB Component Evaluation (new plants only)	• Identify unique plant-specific attributes • Assess impacts of differences on TBS applicability
Risk-Informed Inspection Sample	• 10% of similar metal piping circumferential welds (PWR) or IGSCC Category A welds (BWR) with diameters greater than the TBS. Ongoing inspection programs may be leveraged. • Highest failure potential: combination of lowest toughness and susceptible materials and highest applied and residual stress loads

NUREG-1903 Applicability

- General Approach
- Limiting Locations Selection
- Applicability Demonstration Through ISI Program
- Component Stresses
- Material Properties
- Surface Flaw Analysis
- Seismically Induced Risk of Indirect PLP or RCPB Component Failures

NUREG-1903 Applicability: General Approach



Limiting Locations Selection

- All piping locations with inner diameter greater than TBS
- Represented by the combination of high component stresses and low material fracture toughness, accounting for aging effects over the licensing period
- Susceptibility to service-induced cracking should be considered
- Multiple limiting locations may be needed
- Strive to include all limiting locations in ISI program

Applicability Demonstration Through ISI Program

- For the limiting locations that are part of the plants ISI program, NUREG-1903 applicability is demonstrated through successful application of that program
- No additional analyses are needed if
  - No indications larger than the Section XI, IWB-3500, acceptance criteria are identified
  - No preexisting or new indications are present that are larger than IWB-3500 acceptance criteria

Applicability Demonstration Through ISI Program

- Additional analyses are needed if any identified indication exceeds IWB-3500
  - Follow IWB-3600 but include mean 10^{-6}/yr seismic stress using a structural factor of 1 or
  - Use an alternative approach to conduct a probabilistic analysis
- If limiting locations are not part of an ISI program, then analyses must be used to demonstrate applicability

Component Stresses

Option I: Use NUREG-1903 Results

- Critical piping location in LBB submittal are still applicable
- Normal and SSE stresses from LBB analyses still conservative
- 10^{-6}/yr seismic stresses still applicable

Option II: NUREG-1903 Scale-Factor Method

- Determine seismic hazard information
- Determine service level A & D stresses
- Calculate scale factor per NUREG-1903 to extrapolate SSE stresses to 10^{-6}/yr stresses

Option III: Direct Analysis

- Develop a hazard curve for the site
- Model the site-specific foundation properties for the 10^{-6}/yr seismic hazard.
- Construct a reactor building dynamic model
- Perform a soil, structure interaction analysis
- Address modeling and input uncertainties

Material Properties

- Use the properties in NUREG-1903 if conservative or representative of limiting locations materials
- Develop plant specific properties based on ASME code or experiments
- Appropriateness of properties can be demonstrated by
  - Accounting for any age-related degradation of the strength, toughness, and, if applicable, crack growth rate properties
  - Considering effects on these material properties caused by the elevated loading rates associated with a seismic event
  - Assessing the effects of uncertainty and variability in material properties

Surface Flaw Analysis

- Two options for conducting deterministic analysis

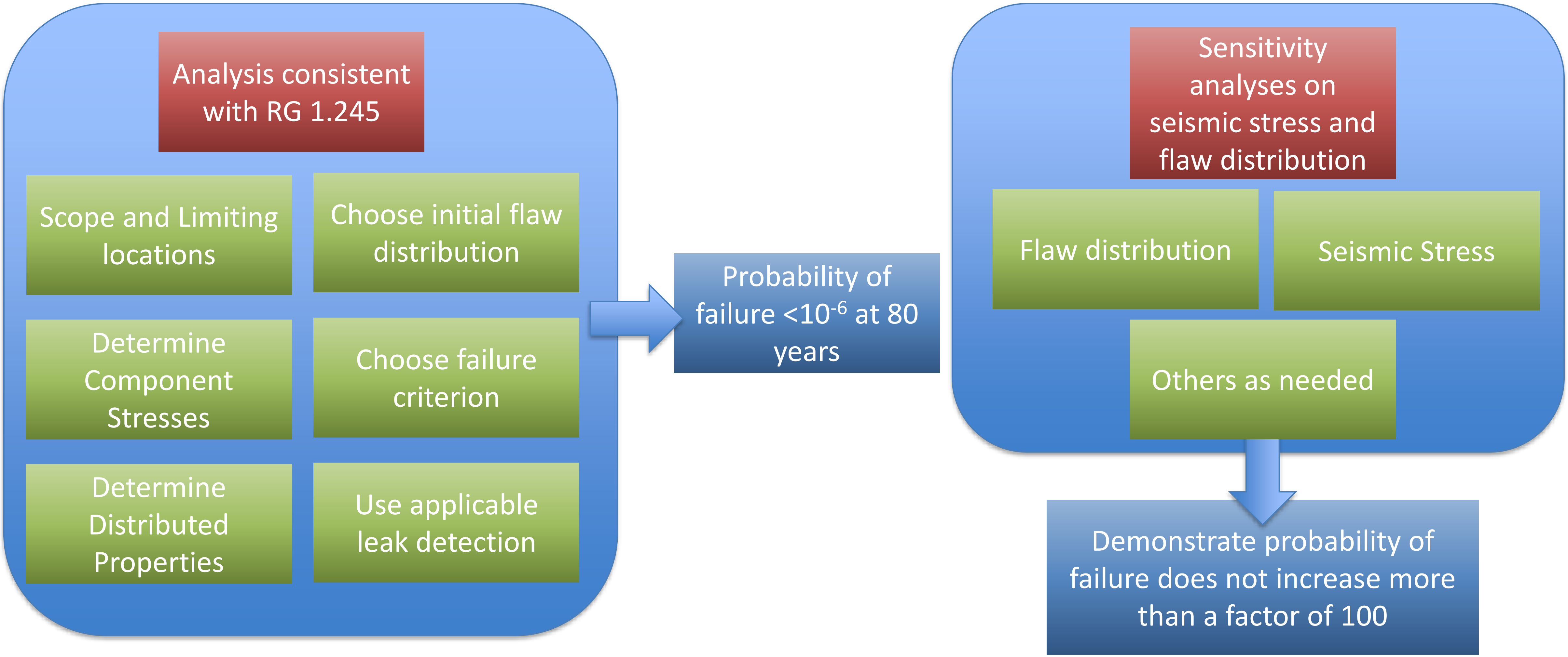
Option I: Bounding Analysis

- Directly utilizes NUREG-1903 results
- Two conditions required for use
  - NUREG-1903 material properties are bounding or representative
  - Component normal operating plus 10^{-6}/yr seismic stresses < 35 ksi
- If conditions met, then NUREG-1903 applicability is demonstrated

Option II: Plant-Specific Analysis

- Utilize plant-specific component stresses and material properties
  - Plasticity effects can be credited to reduce applied stresses above yield
- Calculate critical flaw depth for long surface flaw (i.e., 80% of circumference)
  - Corrected limit load analysis (i.e., Z-factor approach) or elastic plastic fracture mechanics can be used
- Demonstrate that critical flaw is appropriately deep (i.e., > 25% of wall thickness)

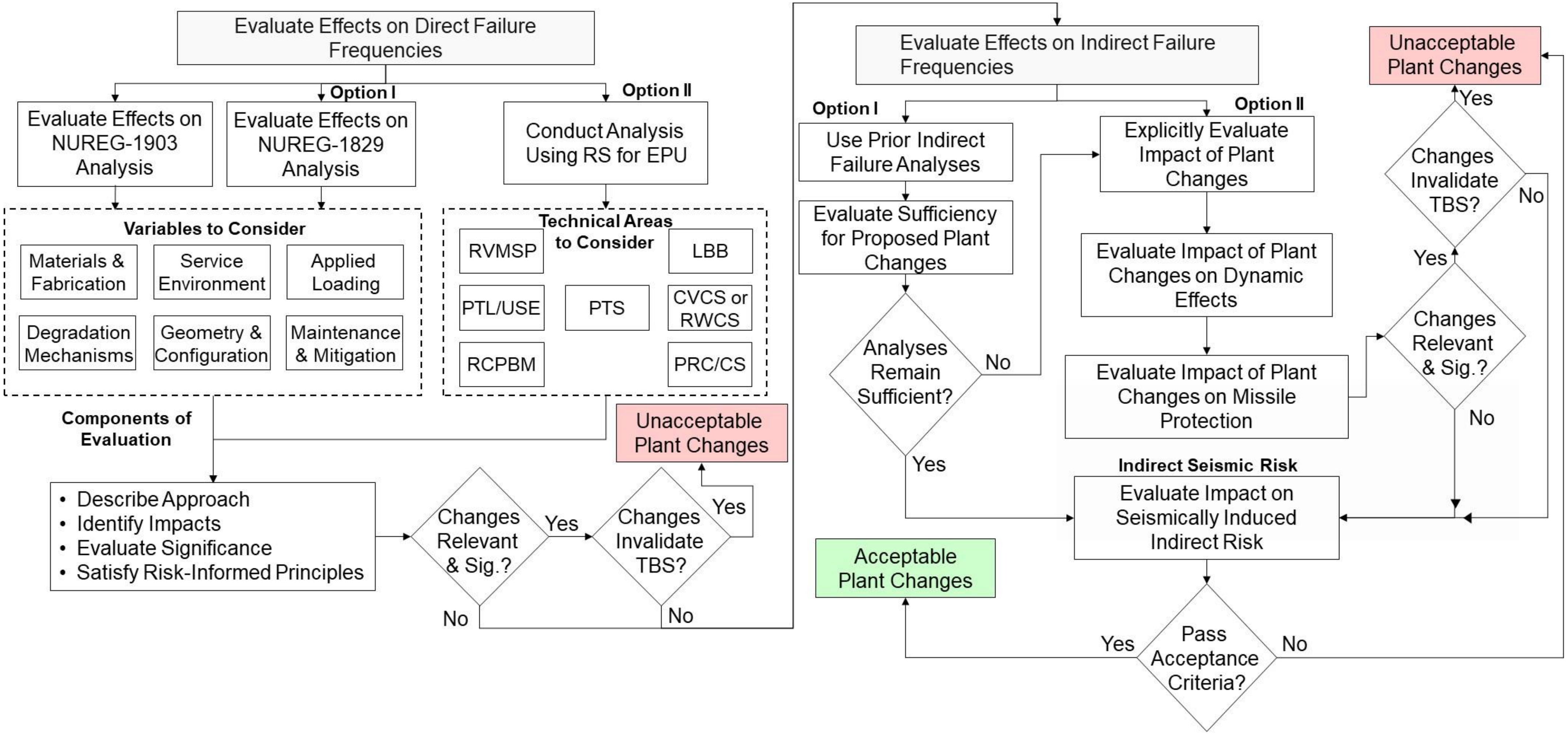
Option III: Plant-Specific Probabilistic Analysis



Seismically Induced Risk of Indirect Component Failures

- An acceptable analysis would include:
  - most up-to-date seismic hazard information
  - plant-specific component and support fragilities
  - impacts of age-related degradation
- Plant-specific seismic PRA that complies with RG 1.200 is acceptable
- Methods other than seismic PRAs may be acceptable
  - seismic margin assessment
- Risk-informed evaluation described in DG-1426 is applicable and provides additional guidance and acceptance criteria

Impact of Plant Changes: General Approach



Plant Changes and LOCA Frequencies

- Entities must demonstrate that proposed plant changes do not significantly increase LOCA frequencies such that TBS remains applicable
  - Both direct and indirect failures should be considered
  - Failures under normal loads, design basis and rare seismic loading (as in NUREG-1903) should be considered
  - Age related degradation should be considered
  - A risk-informed evaluation should be conducted to demonstrate plant changes do not significantly increase LOCA frequencies.
    - More guidance in DG-1426

Plant Changes and Direct Failure Frequencies

- Continued applicability to both NUREG-1829 and NUREG-1903 to be demonstrated

Option I: Effects on NUREG-1829 Variables

- Identify if change affects materials, environment, loading, degradation, geometry, maintenance or mitigation
- Identify if change may introduce new degradation
- Assess and describe performance monitoring program

Option II: Review Standard for Extended Power Uprates

- Use guidance for EPUs
- Focus on RPV surveillance, PT limits, USE, PTS, LBB, piping materials and supports, chemical control, etc.
- Assess and describe performance monitoring

Plant Changes and Direct Failure Frequencies

- Evaluate effects on NUREG-1903 analyses
  - Verify changes do not impact the inspections at limiting locations
  - Determine if change increases degradation rates
  - Determine if surface flaw analyses remain applicable
    - Determine if the change increases stress at limiting location
    - Determine if the change may decrease strength or toughness, or increase crack growth rate of materials
    - Determine if surface flaw analyses still meet acceptance criterion

Plant Changes and Indirect Failure Frequencies

- Ensure that GDC-4 is met and that risk of indirect seismic failures remains acceptable
- Continued adherence to GDC-4
  - Dynamic effects (e.g., pipe whip and jet impingement) and missile protection
  - **Option I**: Prior analyses unaffected by plant changes or existing analyses remain sufficient (no additional evaluation needed)
  - **Option II**
    - Supplement existing evaluations to evaluate relevance and significance of proposed changes to demonstrate that they do not invalidate the TBS
    - Utilize existing guidance in NUREG-0800 (SRP) 3.6.2 (Dynamic Effects) and 3.5.1.1/3.5.1.2 (Missile protection)
- Indirect seismic failure risk
  - Demonstrate that associated risk due to plant change meets proposed rule change requirements
  - Utilize DG-1426 guidance for assessing risks

Appendices

- Appendix A: Detailed Information for Conducting Plant-Specific Analyses Using the NUREG-1903 Approach
  - Contains information pertaining to the direct piping failure analysis in NUREG-1903
  - Table A-1 lists the PWR plants evaluated in NUREG-1903
  - Table A-2 provides the information obtained from NUREG-1488[3] to develop the seismic component stresses
  - Table A-3
    - Provides information submitted as part of LBB evaluations used in analysis
    - Provides intermediate and final analysis results
- Appendix B: Example Calculation for Hot Leg
  - **Critical location**: Girth weld of an SA312-TP304N seamless pipe to reactor pressure vessel nozzle
  - Provides step-by-step calculation of the deterministic, plant-specific surface flaw analysis using the NUREG-1903 scale factor approach (i.e., Option II on Slide 23)

[3] NUREG 1488, "Revised Livermore Seismic Hazard Estimates for Sixty-Nine Nuclear Power Plant Sites East of the Rocky Mountains," (ML20069B899)

DG-1428 Summary

- Evaluation required to demonstrate that breaks greater than TBS remain unlikely
  - **Direct failures**: primary coolant systems and components that could lead to breaks greater than TBS
  - **Indirect failures**: failures of other components that could lead to breaks greater than TBS
- DG-1428 provides guidance for conducting these evaluations
  - Uses DG-1216 as the starting point while streamlining and simplifying that guidance
  - Increases scope of DG-1216 to provide guidance on addressing indirect seismic failures
  - Comments received on DG-1216 considered during development
  - Leverages DG-1426 and other applicable long-standing guidance (e.g., SRP 3.6.3)
- DG-1428 provides several options for demonstrating TBS applicability
- Plan to work with stakeholders, ideally through a pilot study, to identify most viable options and further refine guidance before finalizing

Acronyms

ASME	American Society of Mechanical Engineers
BWR	Boiling Water Reactor
DG	Draft Guide
EPU	Extended Power Uprate
FFRD	Fuel, Fragmentation, Relocation and Dispersal
FRN	Federal Register Notice
ISI	Inservice Inspection
LBB	Leak before Break
LOCA	Loss of Coolant Accident
LR	License Renewal
NEI	Nuclear Energy Institute
PFM	Probabilistic Fracture Mechanics
PLP	Primary Loop Piping
PRA	Probabilistic Risk Assessment
PWR	Pressurized Water Reactor
PWROG	PWR Owners Group
RCPB	Reactor Coolant Pressure Boundary
SLR	Subsequent License Renewal
SRP	Standard Review Plan
TBS	Transition Break Size

Questions

Back-up Slides

10 CFR 50.46a: Related Application Requirements

- (c)(1)(i) requires existing plants to submit "(a) written evaluation demonstrating applicability of the TBS to the entity's facility. The effects of the initial plant changes proposed in the application must be considered as part of this evaluation."
- (c)(2) requires new-plant applicants to submit "… an analysis demonstrating why the proposed reactor design is similar to the designs of reactors licensed under this part before December 31, 2015, such that the provisions of this section may properly apply. The analysis must also include a recommendation for an appropriate TBS and a justification that the recommended TBS is consistent with the technical basis for this section. The effects of the initial plant changes proposed in the application must be considered as part of this evaluation."
- (c)(1)(v)(C) requires, for making changes without prior NRC approval, "(a) description of the approach, methods, and decision-making process to be used to evaluate the continued applicability of the TBS with the acceptance criteria used in the evaluation…" from paragraphs (c)(1)(i) or (c)(2), as applicable
- (c)(1)(vii) requires "(a) written evaluation demonstrating how the leak detection program in place at the facility satisfies the criteria in paragraph (d)(2) of this section."
- (c)(3) "The NRC may approve an application to use this section if…" above evaluations, change process program, or both are acceptable, as applicable.

10 CFR 50.46a: Related Implementation Requirements

- (d)(2) requires that “(t)he entity must have leak detection systems available at the facility and must implement actions during operation as necessary to identify, monitor, and quantify leakage to ensure that adverse safety consequences do not result from leaking primary pressure boundary components that are larger than the TBS”.
- (d)(4) requires that “(t)he entity must perform an evaluation to determine the effect of all planned facility changes and must not implement any facility change that would significantly increase LOCA frequencies or invalidate the evaluation demonstrating the applicability of the TBS performed pursuant to…” paragraphs (c)(1)(i) or (c)(2), as applicable.
- (h)(1)(iii) for changes without prior NRC approval requires that “(t)he change does not significantly increase LOCA frequencies or invalidate the evaluation demonstrating the applicability of the TBS to the applicant’s facility, performed pursuant to…” paragraphs (c)(1)(i) or (c)(2), as applicable.
- (h)(2)(v) for changes submit for NRC approval requires “… (i)information demonstrating that the proposed change will not significantly increase the LOCA frequencies or invalidate the evaluation demonstrating the applicability of the TBS to the entity’s facility, performed pursuant to…” paragraphs (c)(1)(i) or (c)(2), as applicable.
- (j)(3) Minimal changes: reporting. “No later than 24 months after NRC approval of the entity’s application and every 24 months thereafter, the entity must submit … a short description of each change involving minimal changes in risk made under paragraph (h)(1) of this section in the preceding 24 months and a brief summary of the basis for the entity’s determination pursuant to paragraph (h)(1)(iii) of this section that the change does not invalidate the applicability evaluation made under paragraphs (c)(1)(i) or (c)(2), as applicable.

Sample Problem (Appendix B)

- Example Plant SSE: 0.2g PGA, with Mean Annual Frequency of Exceedance (MAFE) of 5.35E-5/yr
- PGA corresponding to the 1E-6/yr MAFE: 0.876g --> (SSE PGA)/(1E-6 PGA) = 0.876g/0.2g = 4.38
- Highest SSE stress location: Hot Leg (ID = 29", Thickness = 2.45"), TP304N wrought austenitic stainless steel joined by SMAW/SAW --> SSE stress = 12.96 ksi
- Normal plus 1E-6 seismic stress adjusted for seismic scale factor and nonlinear correction, using typical material properties = 26.35 ksi < 35 ksi
- Elastic-Plastic Fracture Mechanics (EPFM)-corrected stress = 43.19 ksi
- Minimum critical surface flaw depth from limit load equations = 0.335 > 0.25 --> OK for TBS

Fuel Dispersal and 50.46a – Changes Since December Meeting

Follow-Up ACRS Subcommittee Meeting
January 2025

Joseph Messina
Nuclear Methods and Fuel Analysis
Office of Nuclear Reactor Regulation

Changes

- Removed 50.46a(c)(3)(v) requirement that any non-safety related equipment credited in the LOCA analysis above the TBS be listed in a plant's Technical Specification.
  - (c)(3)(v): "Non-safety equipment that is credited for demonstrating compliance with the ECCS acceptance criteria in paragraph (e) of this section is identified in the plant's Technical Specifications or appropriate conditions require that any future license applicant lists this equipment in the plant's Technical Specifications;"
  - Licensees should consider on a plant-specific basis whether any non-safety related equipment credited for LOCAs above the TBS should be placed in TS under Criterion 4 of 50.36(c)(2)(ii).
- LOCA definition in 50.46 and 50.46a restored to "breaks ***in pipes*** in the reactor coolant pressure boundary" rather than "breaks in the reactor coolant pressure boundary."

Discussion

Discussion

- 1) Criticality
- 2) Fissile Packaging
- 3) TBS sizes
- 4) FFRD
- 5) Clad testing
- 6) RG 1.183
- 7) Control Room dose
- 8) Broader impacts

IE Rulemaking: Industry Feedback

Al Csontos - NEI
Victoria Anderson - NEI
Jim Stavely - PSEG
Tara Matheny - Duke
Jonathan Chavers - Southern
Baris Sarikaya - Constellation/BWROG
Brian Mount - Dominion/PWROG
Kevin Barber - Westinghouse
Paul Clifford - Framatome

NUCLEAR ENERGY INSTITUTE

January 16, 2025

IE Rulemaking Key Messages

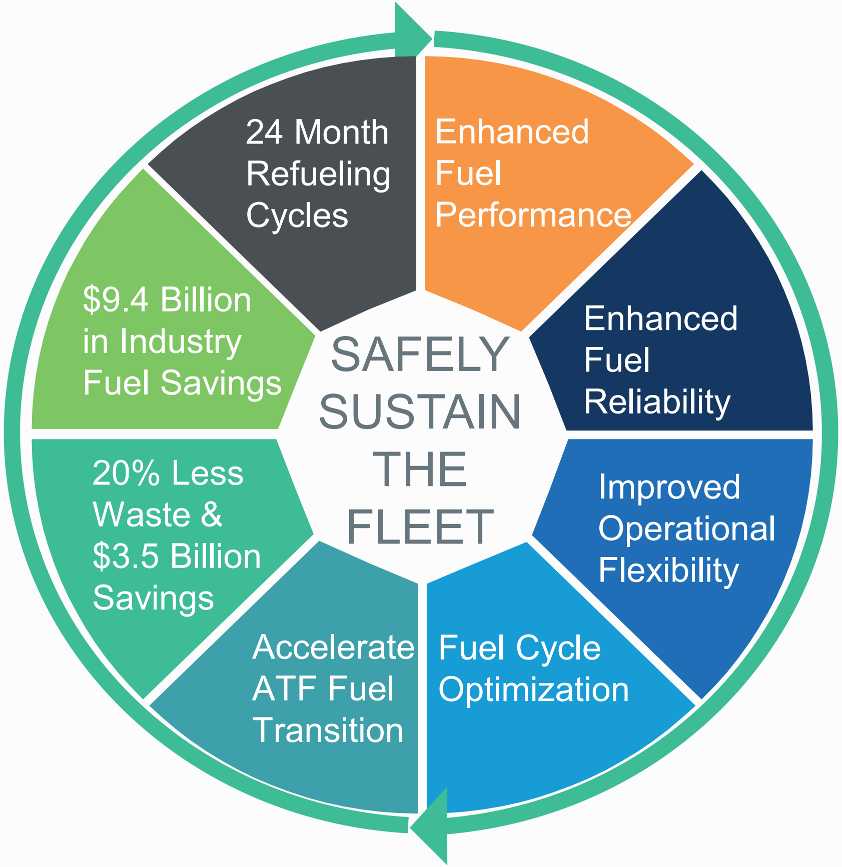
- LARs for uprates and/or advanced fuels are on the way
- IE rule and schedule are vital to industry strategic plans
- Draft IE Rule from the recent ACRS meetings has many appropriate improvements, but major concerns remain
- Industry feedback remains consistent with March ‘23 letter:
  - Combined/modernized rule with modified 50.46a/c (ML23107A230)
- ACRS should allow the draft IE rule for Commission review
- Workshops needed for industry engagement on concerns

ADVANCE Act alignment for modern, risk-informed, and efficient regulations

IE Rulemaking Key Messages

- Generally, beneficial impacts with the overall rule package:
  - Enables improved safety benefits associated with less generated waste
  - Allows increase enrichments to LEU+
  - Allows existing UF_6 packages to ship with up to 10 wt% U-235
  - Improved risk-informed control room dose design criteria
  - RG 1.183 revisions permit some units to move forward with strategic plans
    - More realistic modeling of potential release paths
    - NRC workshops yielded a more predictable, durable, and stable RG
  - Openness to LBLOCA as BDBA has potential for significant improvements
  - NUREG-2266 for up to 10 wt% U-235 and 80 GWd/MTU burnup
- Specific areas remain deterministic, prescriptive, and not risk-informed with additional burdens and high uncertainty to implementation

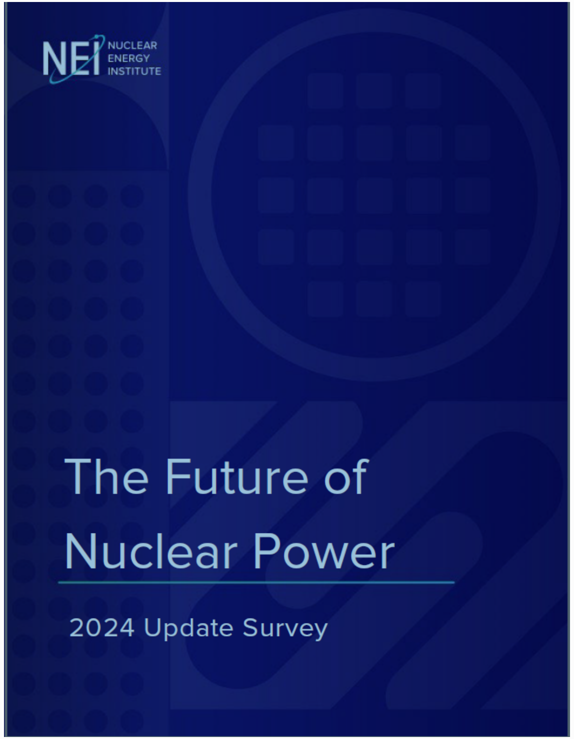
Enabling Advanced Fuel Technologies



- ATF/LEU+/HBU fuels are complementary to uprates and enabling in some cases
- Modern advanced fuel technologies can:
  - Increase potential for power uprates
  - Enable 24-month fuel cycles for PWRs
  - Less waste = improved safety/fuel efficiency
  - Improve plant resiliency and performance
  - Improve economics for fleet sustainment
- On track to meet industry's goal to deploy batch quantities in the mid-to-late 20s:
  - Applications for 24-month cycles submitted
  - Efficient NRC licensing for advanced fuels and uprates by 2027 with the IE rule needed

2024 NEI Future of Nuclear Power Survey

- Key takeaways:
  - **>70% of sites** have a level of interest/planning for one or more power uprates with a combined capacity **increase of 3 GWe**
  - **Nearly 50%** of sites have varying interest/plans for one or more of the enabling changes (ATF/ LEU+, Extended Fuel Cycles, and/or RI LOCA)
- https://www.nei.org/resources/reports-briefs/the-future-of-nuclear-power-2024-survey



Utility Perspectives on Implementation

- PSEG
- Duke
- Southern
- Constellation

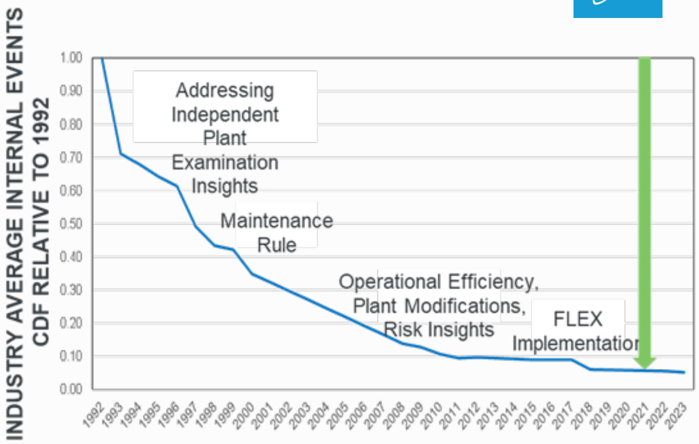
LOCA Risk Significance

IMPACT OF LOCA ON OVERALL PLANT RISK

LOCAs not Significant Contributors to Overall Plant Risk

NEI

- Review of Industry Baseline Risk Index for Initiating Events (BRIIE) – NUREG/CR-6932 for Initiating Events leading to core damage (1988-2005):
  - VSLOCAs have CDFs on the order of 1E-10 (BWRs) and 1E-09 (PWRs) yr^{-1}
    - Small sample of plants confirm. MLOCAs slightly higher but on the order of E-7 to E-8 (PWR, BWRs) yr^{-1} for CDF
    - LERF values ~ 2-3 orders of magnitude smaller than CDF E-9 to E-11 yr^{-1} for LERF
  - Compared to mean CDFs of 1E-05 and 1E-06 yr^{-1}
  - OE Extended to 2020 in INL/EXT-21-63577
  - Plant risk and safety performance have continued to improve (utilities focusing on maintenance and improvements that positively impact risk, safety, and operability)
- Figures on right show plant risk reduced by a factor of 20 (NEI-20-04-The-Nexus-Between-Safety and Operational Performance)



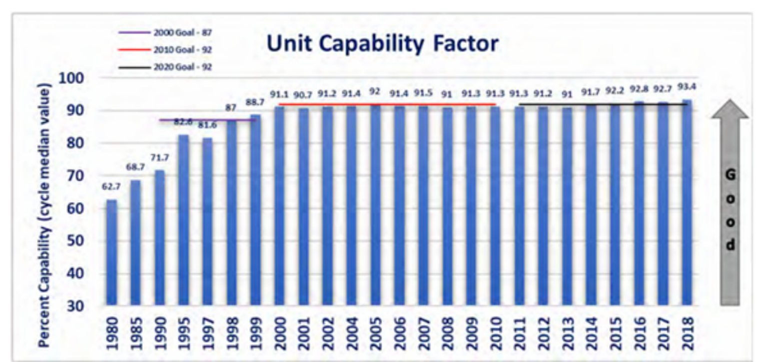


Figure A1 – Unit Capability Factor

Early Industry Draft IE Rule Feedback

AREAS FOR IMPROVEMENT

Implementation

- 2010 Draft 50.46a rule required substantial implementation burden as compared to the potential benefits utilities would obtain (see ML100260383 & ML10316027)
- Risk Informed Evaluation Process (RIEP): New rule does not appear to implement efficiencies and learnings associated with risk informed change programs that most of the fleet has implemented since 2010.
  - More stringent criteria for what requires NRC approval compared to what most of the fleet is approved to use today
  - Draft rule still stipulates the performance of low power shutdown (LPSD) risk assessments/PRAs (NEI 2023 Att. 1, Item 1) even though the industry addressed this after 2010
  - 50.46a (h) RIEP duplicates requirements for implementing risk informed change programs communicated in RG-1.200 and RG-1.174

Implementation

- Existing NRC-approved robust aging management program (submitted as a part of plant license renewals) protects against degradation of primary loop piping (PLP)
  - DG-1428 acknowledges the industry addressed seismic risk per NRC 10CFR50.54 order after Fukushima-Daiichi event but still requires plant specific seismic analyses. (NEI 2023 Att.1, Item 2)
  - DG-1428 imposes additional in-service inspection (ISI) requirements per 50.46 a(b)(3) even though the frequency of rupture is decreasing resulting from maturity increases in PFM

    These increased inspections would result in unnecessary additional occupational dose to plant personnel and is not risk-informed.

  - DG-1428 extension of credit for plants with approved LBB programs is minimal (NEI 2023 Att.1, Item 4)

Implementation

- Additional Implementation Considerations
  - New analyses for 50.46 compliance > TBS
  - New dose analyses for LOCA with FFRD
  - DG-1428 requires the performance of plant specific pipe and component stress evaluations in addition to increased inspection frequencies
  - Draft rule requires new Technical Specifications for non-safety equipment credited in > TBS ECCS compliance analysis (which is beyond design basis) and is inconsistent with Industry's treatment of FLEX equipment
  - Ongoing Activities
    - NRC supporting work to evaluate continued use of TID source term for EQ; The outcome of this could have significant impacts on implementation

Flexible and Durable

- Industry has concerns that draft 50.46a rule is too rigid and prescriptive
  - Draft rule does not allow alternative approaches
  - Codifying a prescriptive TBS definition may lead to future rulemaking and/or exemption requests
- NRC has communicated desire to allow alternative paths
- With minimal changes in rule language, a more flexible and durable rule capable of supporting advancements in risk-informed applications is achievable

Flexible and Durable

- Rule should be structured to allow alternative approaches to defining and implementing TBS
    - Regulation should allow a TBS demarcation which separates beyond design basis based on risk-insights
    - Current TBS definition (50.46a(a)(9)) and SOC bases should be moved to regulatory guidance (i.e., DG-1428)
    - Analytical requirements in 50.46a(e) need to be flexible enough to allow alternative approaches and where possible moved to regulatory guidance
- These changes enable near-term alternative approaches without the need for exemption requests
- EPRI ALS, true risk-informed metrics (ΔCDF), break frequency, etc.

Flexible and Incorporation of Alternative #4

- NRC staff's FFRD Alternative #4 would focus compliance with respect to dispersed fuel on <u>more restrictive</u> radiological consequence limits
  - Downstream consequences of dispersed fuel, including coolability, are removed from the design basis of ECCS performance
  - Plants must demonstrate compliance to "well within" 10 CFR 50.67 dose limits (i.e., 6.3 rem TEDE)
  - Must consider additional source term associated with dispersed fuel
  - Applies to all break sizes and <u>reactor types</u>
- DG-1425 includes guidance for demonstrating compliance with Alternative #4
- Draft § 50.46 rule does not include an alternative path to enable implementation of Alternative #4
  - Discrepancy needs to be resolved

Modernization

A modernized and risk-informed rule would efficiently enable the deployment of advanced fuel designs, including ATF, higher enrichment and higher burnup

- Industry Advancements
  - Since 2005, fleet has implemented approved risk-informed licensing applications and change processes
  - Lower probability of initiating event identified during reconfirmation of NUREG-1829/NUREG-1903, but Draft RGs require increased inspections

Implementation and inspections should capitalize on currently available information

Modernization

- Industry Standards
  - Effect on risk due to changes at sites are assessed based on RG-1.174
  - >TBS beyond design basis, but reporting requirements increased compared to current design basis LOCA
  - Breakaway oxidation testing requirement does not recognize fuel vendor quality assurance, manufacturing control, and design change procedures

Requirements should account for current industry standards, not increase inspection & reporting requirements for beyond design basis events

- Cladding Embrittlement
  - DG-1263, Rev. 1 does not account for NRC-approved cladding alloys that considered known embrittlement mechanisms

Licensed alloys that considered known embrittlement mechanisms should not require additional licensing actions

Regulatory Stability and Predictability

- Without justification, draft § 50.46 and § 50.46a extend the long-standing definition of LOCA beyond breaks in piping (original bases* shown below)

  "The wording of the definition of a loss-of-coolant accident has been modified to conform to its long-accepted usage, limiting it to breaks in pipes."

- Extending the definition of LOCA beyond its historical scope has significant consequences to both the existing fleet and future advanced LWRs
  - This change would invalidate the design basis of current fleet
  - The change to the existing § 50.46 definition is not included in the backfitting determination and would render the rule mandatory
- Definition should be restored to its "long-accepted usage" for 40 years

* Original bases in 39 FR 1002, January 4, 1974

Regulatory Stability and Predictability

- Because its a voluntary alternative, NRC's Backfit assessment states that licensees "would not be required to comply with the proposed amendments and would have the option to continue their current treatment of LOCAs"
- Industry agrees with NRC's earlier assessments that LOCA fuel dispersal at current BU limits and § 50.46c research findings are not safety significant
- NRC MD 8.4 states that if a "backfit has not been imposed for cases where a forward fit is being considered, it is unlikely that a change could be justified to be necessary to ensure adequate protection of public health and safety"
- Based on the above, industry expects that future LARs and vendor topical reports which comply with § 50.46 will not to be subjected to new requirements (i.e., continue current treatment of LOCAs)
- Forward-fitting via vendor topicals should not be allowed

Regulatory Stability and Predictability

- Relaxing assumptions generally provides analytical benefits, but interpretation of BDB LOCA requirements can greatly impact fuel dispersal conclusion

  "*… NRC expects that with true best-estimate modeling and realistic assumptions, the quantity of fuel calculated to be dispersed would be eliminated or greatly reduced." (Draft FRN)*

  - BDBA analyses are used to fully understand the capability of the plant design, rather than establishing tech specs and operational limits based on fuel performance
  - BDBA conclusions should not be obscured by artificial biasing
    - Analyses should consider as-expected conditions
    - Conservatism may be included as a matter of convenience, but is not required
  - Characteristics of "true best-estimate" for BDB LOCA
    - Nominal operating values shall be applied (e.g., operational target, midpoint of a range)
    - Break considerations should reflect physical plant geometry (e.g., relative frequencies)
    - Mitigating systems are available and functional (e.g., non-safety, no single failure, offsite power, etc.)
    - Code models should be best-estimate and applied without bias

Summary

- IE rule with 50.46a/c would enable more realistic operational margins for advanced fuels and additional power uprates as incentivized in the IRA
- Alignment of the combined draft rule to Commission direction and intent of the ADVANCE Act for a modern, risk-informed, and efficient regulatory process
- Industry feedback remains consistent with recent NEI letters:
  - Combined/modernized rule with modified 50.46a/c – Mar '23 (ML23107A230)
  - IE Rulemaking Regulatory Basis industry comments – Jan '24 (ML24023A604)
- Development of a clear, efficient, and durable rule with draft regulatory guides needs full consideration of the holistic implementation pathway for licensees
- NRC workshops would enable an open and transparent dialogue on the Industry's implementation, efficiency, predictability, and durability concerns

Backup

“True Best Estimate”

- Assumed operating conditions at time of break reflect most likely state of the plant
  - Nominal values or midpoint of ranges without uncertainty
  - Nominal peaking factors and axial power condition
- Nominal or as-coded models without conservative uncertainties or biases
  - Realistic accident conditions consider all relevant systems
  - Breaks and distribution of sizes can account for physical plant geometry and expected frequencies of occurrence
  - No single failure or loss-of-offsite power
  - Non-safety systems can be credited

Conditions assumed for beyond design-basis accident analysis should not be tied to technical specification limitations

Optimized Risk-Informed Approach

- True risk-informed approach consistent with approved risk-informed programs already existing in plant's license bases
- TBS should be defined based on plant-specific risk profile (e.g. 10-7 CDF)
  - Above TBS, PRA models must continuously demonstrate that plant-specific risk remains below TBS threshold
    - Full LOCA break spectrum included in internal events scenarios
    - More detailed analytical demonstration not needed for insignificant risk
  - At or below TBS, traditional LOCA EMs used for compliance demonstration
- Future changes in plant configuration, operating conditions, and technical specifications assessed to confirm TBS and overall plant risk

Benefits of Optimized Risk-Informed Approach

- Modified Alternative 4
- Universally applicable to BWR and PWR fleet
- Building upon proven risk-informed regulatory process
- Demonstrated no fuel dispersal
    - Avoids complex, downstream consequence analyses
- Removes reporting requirements

Considerations/Clarifications for Modernized 50.46a Rule

Consideration/Clarification	Justification

LOCAs > transition break size (TBS) would be treated as beyond design basis with realistic assumptions. NRC approved thermal-hydraulics method may not be needed for large breaks.	• > TBS = Beyond Design Basis is consistent with intent of 50.46a (SECY-10-0161)
	• Considerations based on information in Reactor Accident Analysis Modernization Report: Item 2.4 (ML24220A292)
	  • Use of Chapter 19 methods could be acceptable (Section 2.4.1)?
	  • Demonstrate compliance with RG-1.200 acceptance criteria (including DiD), and NRC review and approval may not be required?

LOCAs < TBS (design basis) could take credit for RI single failure, some non-safety SSCs, and use alternate criteria to demonstrate high probability?	• LOCAs are not significant contributors to plant risk and ECCS performance is not credited to satisfy dose acceptance criteria? • Based on industry interpretation of RAAM Items 2,2, 2.3, 2.6
Selection of TBS could be based on risk criteria (CDF, LERF)?	• Draft 50.46a rule used initiation event frequency which is not a true risk metric (omits consequences)?
Separate approval of some changes under 50.46a may not be required?	• Utilities that have received approval for other RI programs would receive credit for QA of RI change programs? • Evaluation of changes under RG-1.174 for RI programs and 50.59 are well vetted and established.
Site specific seismic risk demonstrations under NUREG-1903 would not be required?	• Utilities have addressed plant specific seismic risk as a part of Post-Fukushima Task Force requirements/recommendations
Implementation of a modernized 50.46a would be voluntary?	• Consistent with 2010 draft 50.46a rule

Implementation Burden

- 2010 Draft 50.46a rule required substantial implementation burden as compared to the potential benefits utilities would obtain (see ML100260383 & ML10316027)
  - **Risk Informed Evaluation Process:** New rule does not appear to implement efficiencies and learnings associated with risk informed change programs that the majority of the fleet has implemented since 2010
    - Specifies use of Region III ΔCDF (1.0 E-07) and ΔLERF (1E-08) criteria in RG-1.174 to determine if a change is acceptable
    - Requires any change processed under 50.46a to be approved by NRC if the change falls outside of Region III
    - Whereas other approved risk informed programs use a Region II criteria
    - ACRS in response to Issue 3 (ML070460275) recommended Region II criteria [ΔCDF (1.0 E-06) and ΔLERF (1E-07)] for changes and that any changes that increase risk > Region II criteria should require staff review

Implementation Burden

- Justification for applicability of the transition break size (TBS) contained in DG-1428 requires more reactor coolant piping weld inspections (NUREG-1829) and plant specific seismic evaluations (NUREG-1903)
  - DG-1428 (Section B.2) acknowledges the industry addressed seismic risk per NRC 10CFR50.54 order after Fukushima-Daiichi event.
  - DG-1428 (B.1.3) imposes additional in-service inspection (ISI) requirements per 50.46 a(b)(3) even though presentations to ACRS on 12/17/24 demonstrate that the frequency of rupture is decreasing resulting from maturity increases in PFM. These increased inspections would result in unnecessary additional dose to plant personnel.

LOCA Category	Effective Break Size (inch)	Plant-Level LOCA Frequency (1/Year) – Statistical Mean Values			
		BWR - Piping		PWR - Piping	
		NUREG-1829	2024 Update	NUREG-1829	2024 Update
4	≥ 7	5.9E-06	2.4E-08	7.6E-07	6.0E-08
5	≥ 18	1.0E-06	4.3E-09	1.3E-07	2.6E-08
6	≥ 41	--	--	1.2E-08	4.0E-10

Implementation Burden

- Implementation of the draft rule would also require new analyses:
  - DG-1425 requires a new dose analysis “LOCA with FFRD” with an acceptance criteria 25% of MHA LOCA even though DG-1425 acknowledges MHA LOCA bounds LOCA with FFRD.
    - LOCA with FFRD is valid under Alternative 4
  - 50.46a rule requires a **new** “true best-estimate” LOCA analysis for breaks > TBS, still requires deterministic LOCA analysis that must be maintained by the Licensee, in addition to the current LOCA analyses for breaks ≤ TBS
  - Draft rule still requires compliance to 50.46 design basis acceptance criteria for both analyses even though it is recognized > TBS is beyond design basis
  - DG-1428 requires the performance of plant specific pipe and component stress evaluations along with ISI inspection information that needs to be approved by the NRC to use a TBS
  - DG-1428 requires the performance of a plant specific seismic evaluation for pipe and components that could fail and impact pipe pressure boundary performance, while acknowledging plants have already addressed seismic risk
  - New TS (Never could find in what document the new TS is required

Modernization

- The draft rule does not reflect the significant advancements in licensing actions, including risk-informed applications, since the draft § 50.46a rule was first developed in 2005
- Applicability of § 50.46 and DG-1263 should be expanded to include all approved cladding alloys
  - Demonstration of acceptable performance already justified
- Since 2005, fleet has implemented approved risk-informed licensing applications and change processes
  - Duplicative RIEP codified in draft § 50.46a unnecessary
  - Unjustified differences from approved risk-informed applications

Modernization

- Draft § 50.46 and § 50.46a maintain legacy reporting requirements
  - In 1974, computational limitations and uncertainties necessitated reporting to provide “book-keeping” and NRC confidence
  - Unrelated to plant safety
- Given the anticipated large margins to acceptance criteria, “At or Below TBS” reporting should only be required when predictions approach criteria.
- No reporting requirements should be required for “Above TBS” BDBAs
  - Best-estimate, realistic calculations are not deterministically bounding, therefore “book-keeping” is unnecessary
- Licensees required to take corrective actions to ensure compliance
  - This legacy reporting requirement should be removed

Summary of EPRI's Alternative Licensing Strategy to Address LOCA induced FFRD

Fred Smith
Sr. Technical Executive

ACRS Meeting of the Fuels Materials, & Structures Subcommittee
January 16, 2025

Date: Add submission date and/or revision date & #

Alternative Licensing Strategy Purpose

Purpose:

Provide technical justification to exclude consideration of fuel fragmentation, relocation, and dispersal (FFRD) from the core cooling evaluation for a loss of coolant accident (LOCA) in a pressurized water reactor (PWR) to allow increasing the fuel burnup limit.

Problem Statement

FFRD involves multiple phenomena potentially induced in high burnup (HBU) fuel by large-break (LB) LOCAs. The usual approach of validating methodology against empirical data does not support desired schedule.

Proposed Approach

Based on precedents and on existing regulations and guidance define a methodology that shows that:

1) Burst of clad of high burnup fuel is not credible for LB-LOCAs
2) Smaller LOCAs do not cause clad burst

ALS Overview

- Submitted for Review April 26, 2024

  [1] *Loss-of-Coolant-Accident-Induced Fuel Fragmentation, Relocation, and Dispersal with Leak-Before-Break Credit – Alternative Licensing Strategy*. EPRI, Palo Alto, CA: 2024. 3002028673.

  [2] *Materials Reliability Program: xLPR Estimation of PWR Loss-of-Coolant Accident Frequencies* (MRP-480). EPRI, Palo Alto, CA: 2024. 3002023895.

  [3] *LOCA Analysis of Fuel Fragmentation, Relocation, and Dispersal for Westinghouse 2-Loop, 3-Loop and 4-Loop Plants – Proprietary, Evaluation of Cladding Rupture in High Burnup Fuel Rods Susceptible to Fine Fragmentation*. EPRI, Palo Alto, CA: 2024. 3002028674.

  [4] *LOCA Analysis of Fuel Fragmentation, Relocation and Dispersal for Westinghouse 2-Loop, 3-Loop and 4-Loop Plants – Non-Proprietary, Evaluation of Cladding Rupture in High Burnup Fuel Rods Susceptible to Fine Fragmentation*. EPRI, Palo Alto, CA: 2024. 3002028675.

  [5] EPRI letter #FRP 2024-013, ”Request for Exemption of NRC Review Fees for Electric Power Research Institute (EPRI) - Analysis of PWR LOCA Induced Fuel Fragmentation Relocation and Dispersal (FFRD) for Fuel Operating to Extended Burnup: Alternative Licensing Strategy,” dated April 26, 2024.

- Accepted for review June 25, 2024
- Fee Waiver approved August 1, 2024

Review Schedule

EPRI Report	Fracture Mechanics	SB/IB LOCA	Integrated Report with credit for LBB
Audit Dates	March / April 2025	November 2024 / March 2025	May / June 2025
RAI Schedule	May 23, 2025	July 18, 2025	July 21, 2025
Draft Safety Evaluation	December 4, 2025	February 6, 2026	February 17, 2026
Product ID	3002023895	3002028674 3002028675	3002028673

Allowing 6 months for final approval of all Safety Evaluations – Topical Approval Expected August 2026

Increased Enrichment Rulemaking Schedule:

Rule to Commission September 30, 2026

Rule for Final Publication March 20, 2027

Overview of Analysis Framework

- Main coolant loop piping LOCA
  - Credit Leak-Before-Break (LBB)
  - Informed by Probabilistic Fracture Mechanics (xLPR) results
    - Extended timeframe for operator action to comply with unidentified leak rate technical specifications LCO
- Other smaller connected piping LOCAs
  - Deterministic LOCA analysis
  - Updated for increased burnup and FFRD effects
- Results demonstrate no burst for high burnup fuel
  - No fuel dispersal
- Applicable to PWRs

Realistic Sequence of Events for Main Coolant Piping

- Initial flaw evolves, over many years, into through wall crack
- Small leakage rate approaches T/S unidentified leakage rate (1 gpm)
  - xLPR results demonstrates LOCA will not occur for 19 months even if plant continues full power operation
- Detected by one or more of the follow indications
  - Inventory balance, Makeup flow rate, Containment sump level, Containment pressure, temperature, humidity, particulate activity,…
- Typical T/S requirements
  - Mode 3 (hot standby) in 8 hours
  - Mode 5 (cold shutdown) in 36 hours
- Coolant has insufficient energy to drive piping crack into LOCA configuration
- Decay heat is reduced once power production is ceased
  - 1 Week after shutdown to 0.30 % of full power
  - 1 Month after shutdown to 0.21 % of full power
  - Should a LOCA occur at these reduced decay heat levels, no FFRD consequences are expected

LBB Applications

- Addresses a specific LOCA related performance criteria
- Limited to individual piping systems that meet deterministic fracture mechanics criteria
  - Demonstrate that the probability of fluid system piping rupture is extremely low
- Approved on plant specific basis for individual piping configurations
- LBB already accepted for:
  - Fuel Fragmentation due to broken Baffle-Former Bolts
  - Exclude blowdown forces on control rod insertion
  - Thermal-Mechanical loads on fuel structures

LBB application to ECCS Policy

- Previously evaluated in Federal Register (Vol. 54, No. 83, May 2, 1989)

  "Having considered all public comments received, the Commission has decided not to undertake any rulemaking to extend the applicability of LBB to ECCS or EQ at this time. In large part, <u>any safety benefits associated with ECCS can presently be more readily obtained under the recent ECCS rule</u>. The Commission will consider modifying its current ECCS and EQ regulations when adequate technical justification supports the feasibility and benefits of the proposed modifications."

- ALS Safety Benefits result from faster deployment of lower batch size designs
  - Reduces the number of Dry Cask Loading campaigns
    - Lower Occupational Dose,
    - Lower Site Boundary Dose
    - Reduced transportation accident risk and dose to public during transport
  - Support transition to 24-month fuel cycles
    - Reducing occupational dose and outage related risks
  - Eliminates staff and industry burden for the experimentation and model development and approval of fuel dispersal. This allow scarce highly specialized NRC staff to focus on more risk significant issues.
  - Smaller front end fuel cycle requirements reduces transportation risk
  - More economical fuel designs supports continued operation of nuclear plants, a carbon free energy source
- An open issue exist about the applicability of a beyond design bases event, created by alternative 2, to design base requirements such as GDC 4 as implemented in SRP 3.6.3 (LBB Evaluation Procedures). The LBB policy should be revised to remove this inconsistency.

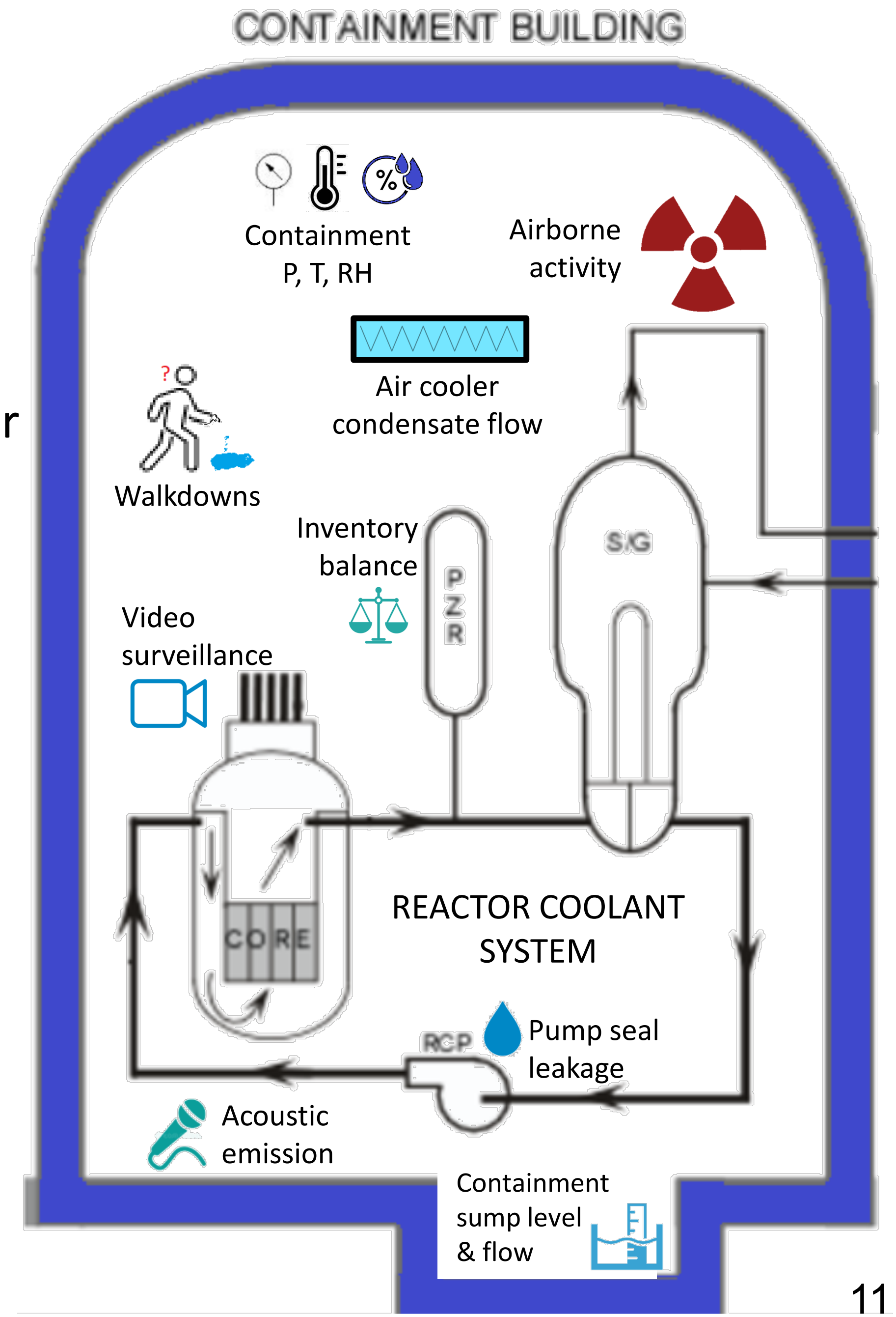
LB-LOCA induced FFRD Precluded

- LB-LOCA induced FFRD has an extremely low likelihood of occurrence as supported by
  - NUREG-1829 expert elicitation
  - Confirmed by xLPR analysis probabilistic fracture mechanics analysis
  - LBB piping qualification process with deterministic fracture mechanics also supports the conclusion that the probability of piping rupture is extremely low
- Layers of Defense that support prevention of LB-LOCA
  - NSSS piping system design (e.g. material selection, geometry…)
  - NSSS piping system fabrication (Q/A, welding procedures, welder qualification, weld inspection…)
  - NSSS normal and abnormal operating procedures that limit piping loads
  - In-service Inspection
  - Leak Rate Detection
    - Many months for detection of small leak
    - Multiple independent methods of detection
    - Leak rate progression makes leakage more evident
    - Undetected leakage to the point of piping rupture is not plausible


Together...Shaping the Future of Energy®

Leak Detection

- Regulatory Guide 1.45, “Guidance on Monitoring and Responding to Reactor Coolant System Leakage”*
  - Unidentified leak rate > 0.05 gpm detection/quantification
  - Response time (excluding transport time) of no more than 1 hour for leak rate of 1 gpm
  - Leakage Monitoring Parameters
    - Inventory balance
    - Containment sump level or flow
    - Airborne particulate activity
    - Air cooler condensate flow
    - Airborne gaseous activity
    - Containment pressure, temperature, humidity
    - Acoustic emission
    - Video surveillance
    - Pump seal leakage
    - Makeup flow rate
    - Walkdowns



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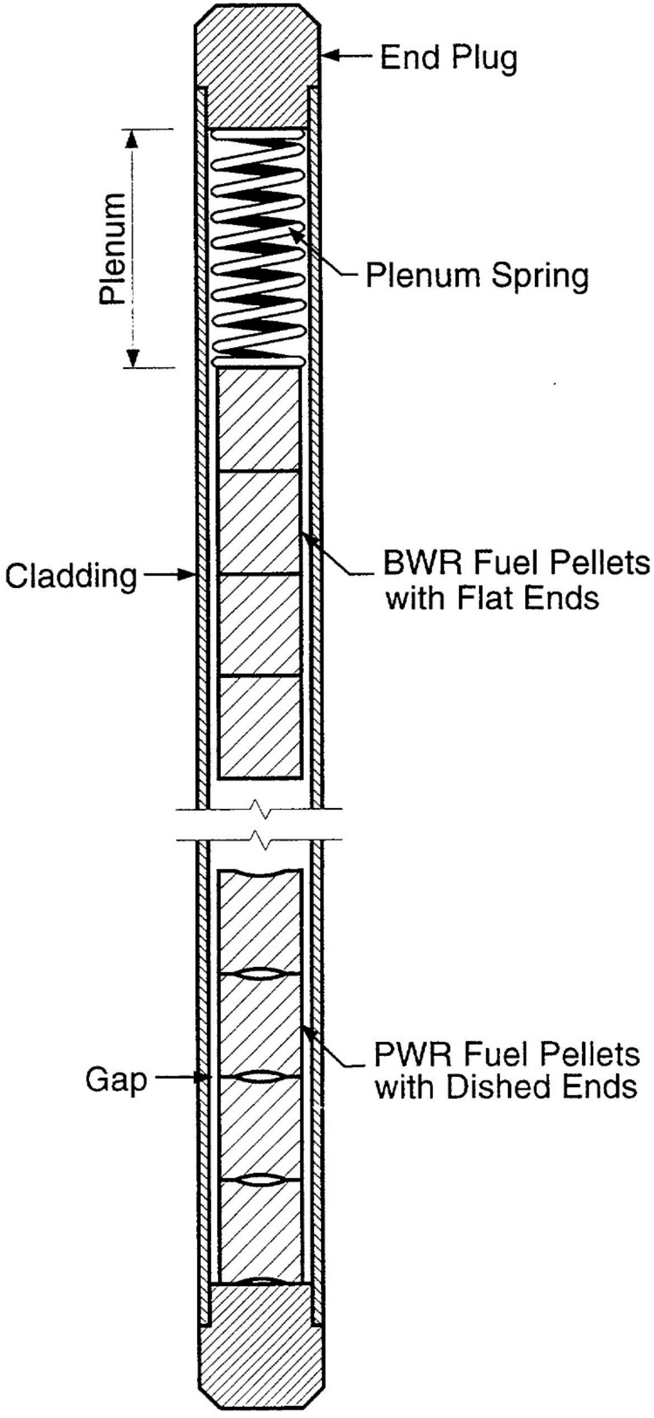
*Most PWRs were licensed to and still apply Revision 0

Comments on Cladding Embrittlement as discussed in the ACRS SC Meeting on December 17, 2024

Ralph O. Meyer, USNRC (retired), and
Wolfgang Wiesenack, Halden Reactor Project (retired)
January 12, 2025



Original Concept for a LOCA Rule
Late 1960s

If a fuel rod heats up in steam during a LOCA, the cladding will eventually become brittle. Brittle cladding will shatter or chunks of it will fall away allowing fuel pellets to get out. A core in such disarray is not a coolable geometry.

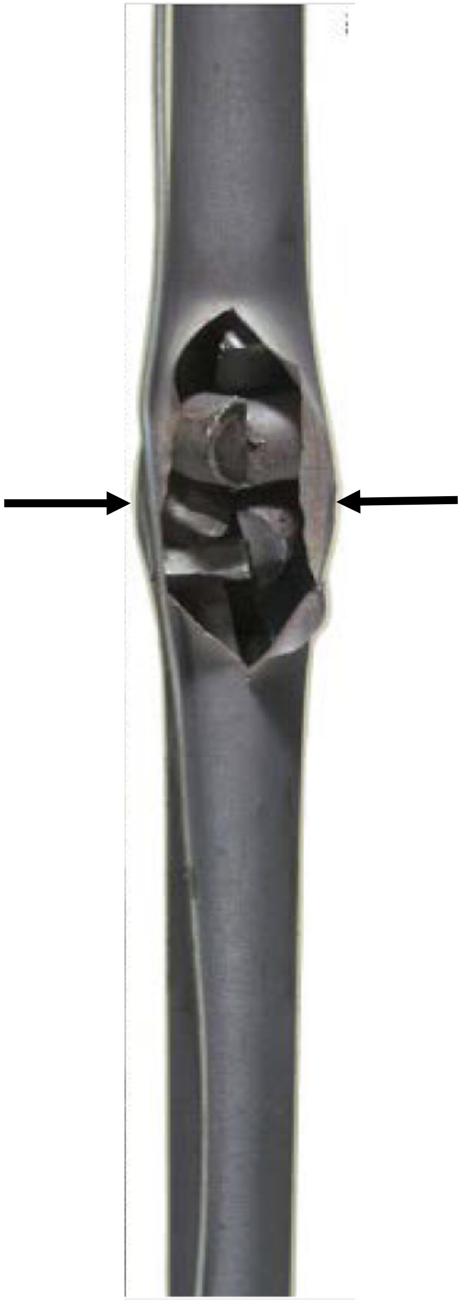
Therefore

Do not permit cladding embrittlement under LOCA conditions.

Surprising First Test Results
Oak Ridge 1971

The fuel rod cladding ballooned and burst at hot spots. Ballooning had not been expected. Embrittlement was localized.

Final Report on the First Fuel Rod Failure
Transient Test of a Zircaloy-clad
Fuel Rod Cluster In Treat
(ORNL-4635, MARCH 1971)
R. A. Lorenz, D. O. Hobson, and G. W. Parker

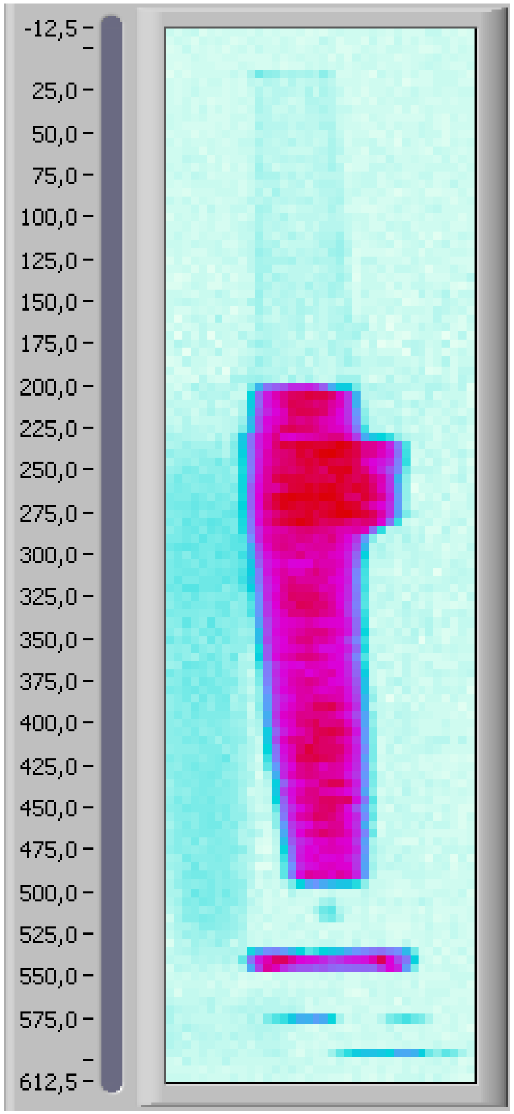


Modified Concept for the LOCA Rule 1973

- Apply embrittlement criteria where cladding is thinnest and embrittlement would occur first.
- Add a time limit because localized embrittlement would occur faster.
- Use oxidation as a surrogate for time.

The limits adopted were:
2200 ^{0}F Peak Cladding Temperature
17 % Maximum Cladding Oxidation

How fuel pellets or fragmented particles might escape was not considered. It was assumed that fuel would remain within the cladding if the cladding were not embrittled.



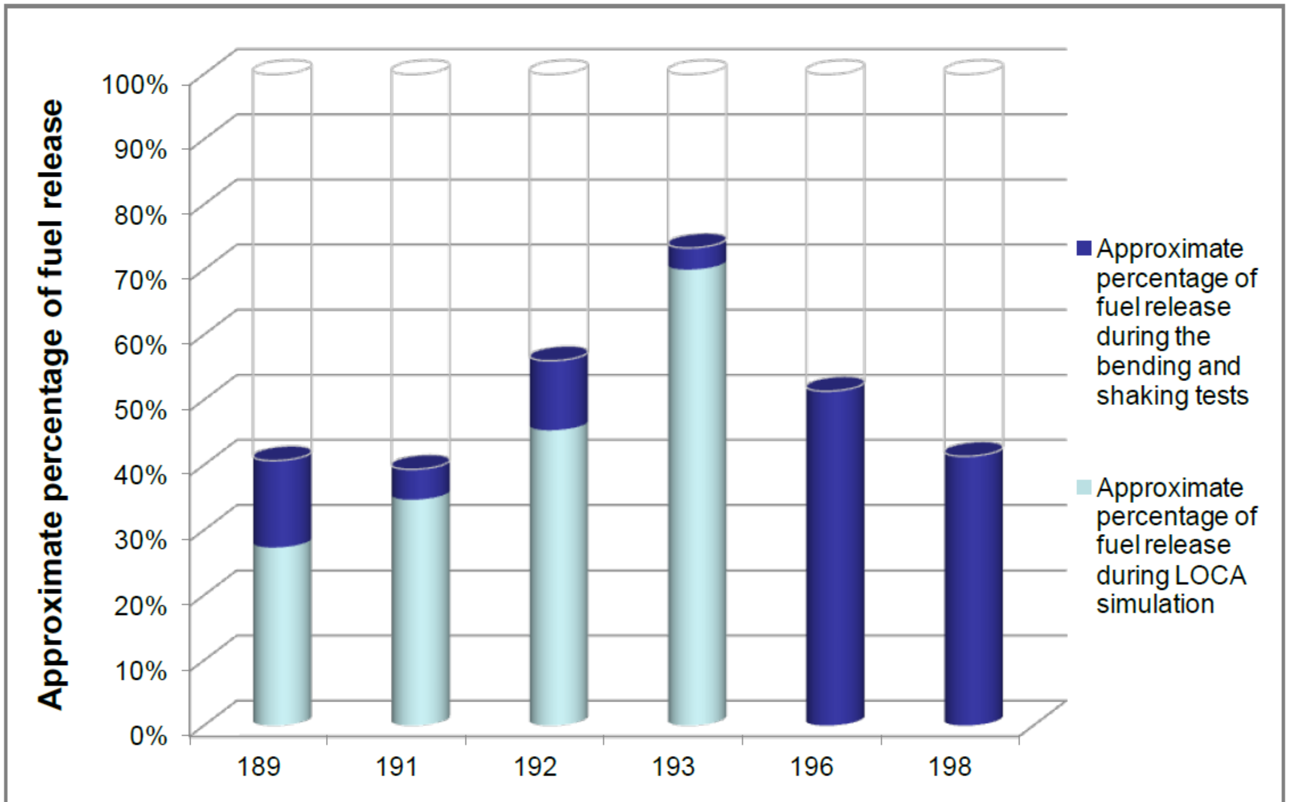
Tests on High Burnup Fuel Rods Halden 2006

In this LOCA test, the upper half of the rod became void of fuel. Fuel had filled the balloon, and some had fallen to the bottom of the test vessel.

Pellet fragments were often observed to be very small as the result of rapid expansion of fission gas that was trapped in voids in the pellet microstructure.

Summary of the Halden Reactor Project
LOCA Test Series IFA-650
(HPR-380, May 14, 2013)
Wolfgang Wiesenack

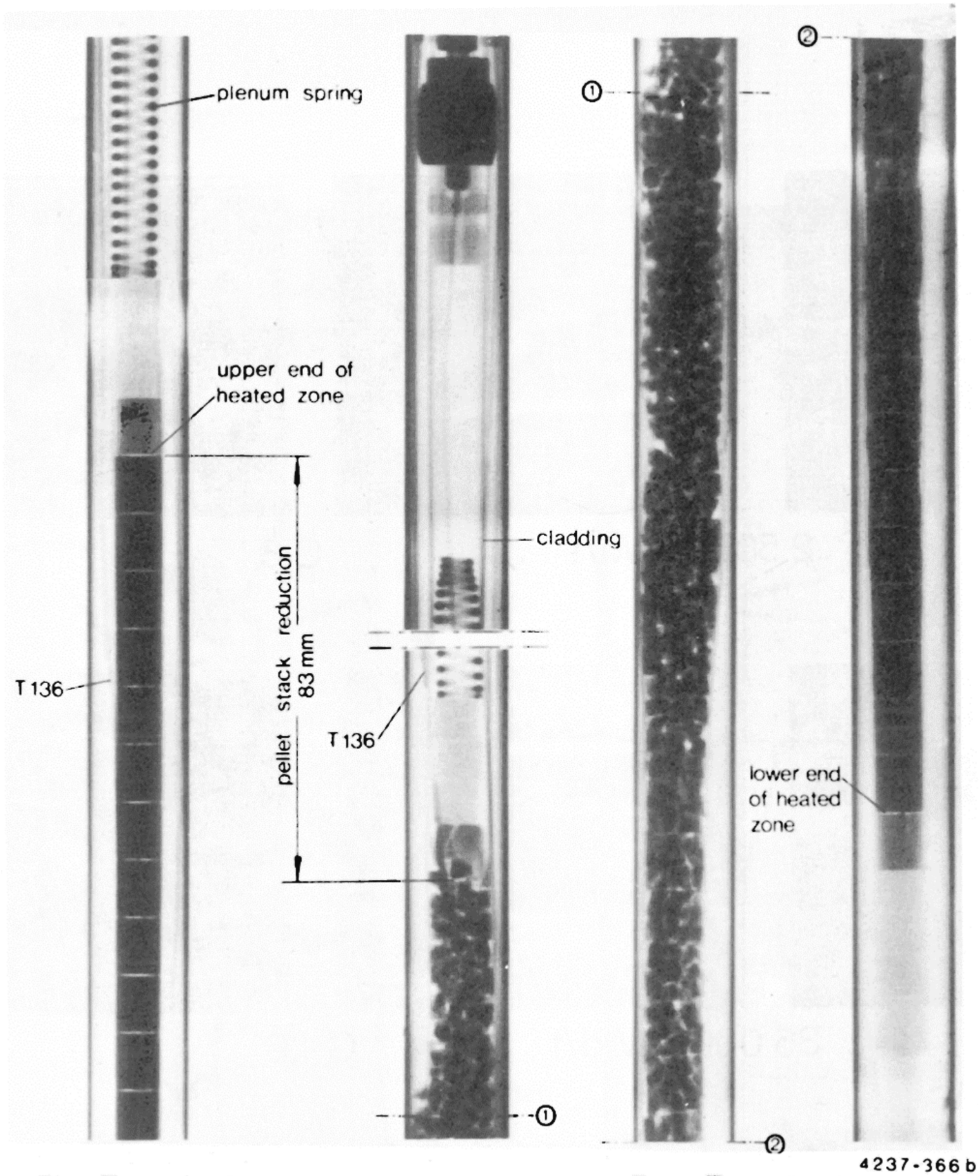
Tests on Medium Burnup Fuel Rods
Studsvik 2013



Test numbers 189 - 198

Approximate percentage of fuel loss during each test, color-coded by when fuel loss occurred.

Post-Test Examination Results from Integral, High-Burnup, Fueled LOCA Tests at Studsvik Nuclear Laboratory
(NUREG-2160, August 2013)
Michelle E. Flanagan,
Peter Askeljung, and Anders Puranen



Pre-Transient

Post-Transient

Tests on Low Burnup Fuel Rods Karlsruhe 1983

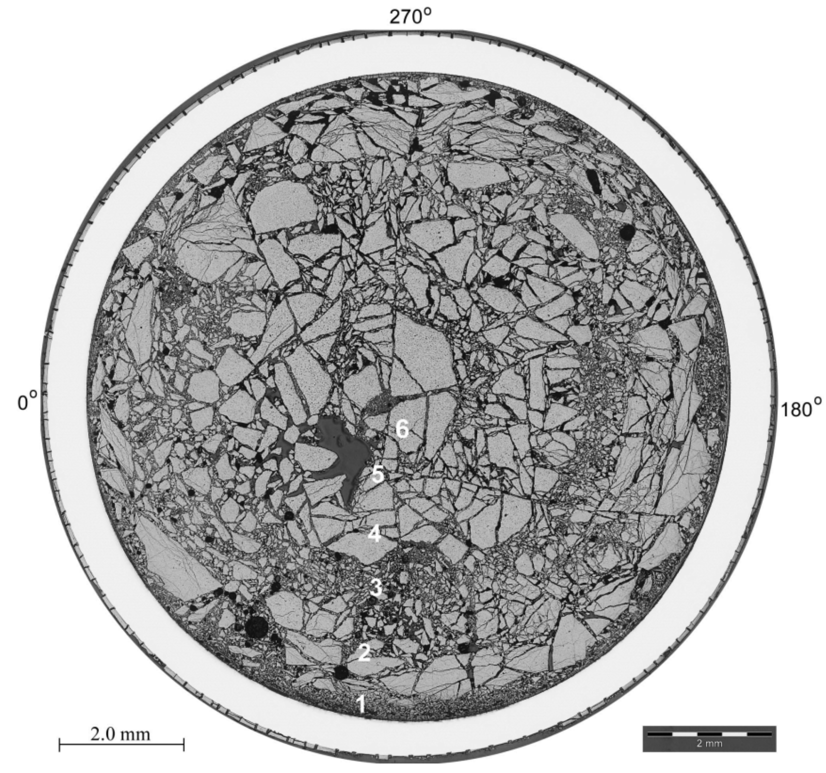
Tests with previously irradiated rods resulted in fragmented fuel pellets in the rod sections with major deformation. Pellet fragments relocated outward and downward, filling the space in the fuel rod created by the balloon.

LWR Fuel Rod Behavior in the FR2 In-pile Tests Simulating the Heatup Phase of a LOCA
(KfK 3346, March 1983)
E. H. Karb, M. Prüßmann, L. Sepold, P. Hofmann, and G. Schanz

Possible Impact of Higher Enrichment

When low-enrichment fuel rods are irradiated to high burnup, much of the burnup is accumulated through Pu fission in the outer part of the pellet, eventually creating an ultra high burnup rim containing a lot of fission gas. Rapid expansion of this gas is believed to be a driving force for fuel particle expulsion when cladding bursts during a LOCA.

In higher enrichment fuel with the same burnup, more fission gas will reside in the interior of the fuel pellet, induce microstructural changes, and possibly contribute to energetic fuel expulsion.



Fuel (83 MWd/kgU) subjected to LOCA

CONCLUSION

50.46(b)(1) and (2) should be Replaced and Appendix K should be Eliminated

- Ballooning and burst always occur before embrittlement.
- Burst openings are large enough for fuel to get through
- Fuel expulsion is possible at low burnup and inevitable at high burnup
- Higher enrichments may affect fuel dispersal
- Embrittlement criteria are harmful because they result in core designs and power levels that keep the temperature from getting too high on the limiting rod (a single rod calculation) when cores should be operated to minimize the number of rods that burst (a core-wide calculation).

POSTSCRIPT

- The staff knows how to draft language for this rule change (see letter to the Secretary of the Commission, August 25, 2024).
- The proposed rule does not prescribe the number of permissible rod bursts but rather requires the number to be specified and acceptable.
- The proposed rule resolves FFRD subject only to the performance of confirmatory research – analogous to the 1973 approach.
- This proposed correction to LOCA criteria is a result of earlier confirmatory research performed by NRC, either through direct funding, contribution to cooperative programs, or formal technical exchanges.