Official Transcript of Proceedings

NUCLEAR REGULATORY COMMISSION

Title: Advisory Committee on Reactor Safeguards

Docket Number: (n/a)

Location: teleconference

Date: Wednesday, February 5, 2025

Work Order No.: NRC-0197 Pages 1-89

NEAL R. GROSS AND CO., INC.
Court Reporters and Transcribers
1716 14th Street, N.W.
Washington, D.C. 20009
(202) 234-4433

DISCLAIMER

UNITED STATES NUCLEAR REGULATORY COMMISSION'S ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

The contents of this transcript of the proceeding of the United States Nuclear Regulatory Commission Advisory Committee on Reactor Safeguards, as reported herein, is a record of the discussions recorded at the meeting.

This transcript has not been reviewed, corrected, and edited, and it may contain inaccuracies.

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

+ + + + +

722ND MEETING

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

+ + + + +

WEDNESDAY

FEBRUARY 5, 2025

+ + + + +

The Advisory Committee met via Video/Teleconference, at 8:30 a.m. EST, Walter L. Kirchner, Chair, presiding.

COMMITTEE MEMBERS:

WALTER L. KIRCHNER, Chair

GREGORY H. HALNON, Vice Chair

DAVID A. PETTI, Member-at-Large

RONALD G. BALLINGER, Member

VICKI M. BIER, Member

VESNA B. DIMITRIJEVIC, Member

CRAIG D. HARRINGTON, Member

ROBERT P. MARTIN, Member

SCOTT P. PALMTAG, Member

THOMAS E. ROBERTS, Member

MATTHEW W. SUNSERI, Member

ACRS CONSULTANTS:

STEPHEN P. SCHULTZ

DENNIS C. BLEY

DESIGNATED FEDERAL OFFICIALS:

QUYNH NGUYEN

LAWRENCE BURKHART

CHRISTOPHER BROWN

WEIDONG WANG

ALSO PRESENT:

PHILIP A. BENAVIDES, NMSS/REFS/RRPB

THERESA V. CLARK, NRR/DSS

JAMES R. CORSON, JR., RES/DSA/FSCB

AL CSONTOS, Nuclear Energy Institute

ELIJAH D. DICKSON, NRR/DRA/ARCB

DARRELL S. DUNN, NMSS/DFM/MSB

SCOTT T. KREPEL, NRR/DSS/SFNB

EDWIN LYMAN, Union of Concerned Scientists

JOSEPH MESSINA IV, NRR/DSS/SFNB

CHARLEY A. PEABODY, JR., NRR/DSS/SNSB

JASON M. PIOTTER, NMSS/DFM/NF

DAVID L. RUDLAND, NRR/DRNL

JAMES STAVELY, PSEG Nuclear

CONTENTS

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

8:30 a.m.

CHAIR KIRCHNER: Good morning. The meeting will now come to order. This is the first day of the 722nd meeting of the Advisory Committee on Reactor Safeguards, ACRS. I am Walt Kirchner, Chair of the ACRS.

ACRS members in attendance, in person, are Ron Ballinger, Greg Halnon, Robert Martin, Scott Palmtag, Dave Petti, Thomas Roberts, Craig Harrington and Vicki Bier. ACRS Members in attendance virtually via Teams are Matt Sunseri and Vesna Dimitrijevic. We also have with us, our consultant Steve Schultz. And online our Consultant Dennis Bley. I've missed anyone please speak up. Hearing no one, okay.

Christopher Brown and Weidong Wang of the ACRS Staff are the designated federal officers for the first and second portions of this mornings full committee meeting. I know that we have a quorum.

Our first topic is Reg Guide 3.78 and ASME Code Cases. Member Harrington recused himself due to potential conflict of interest on this topic.

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's bylaws, the ACRS speaks only through its published reports therefore all Member comments should be regarded as only the individual opinion of that Member and not a Committee position.

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

The ACRS, 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 no statements for a request to make an oral statement from the public, however, we set aside time at the end of this meeting for public comments. Written statements may be forwarded to today's designated federal officers. The transcript of the meeting is being kept and will be posted on our website.

When addressing the Committee, the participants should first identify themselves and speak with sufficient clarity and volume so that they may be readily heard. When you're not speaking please

mute your computer on Teams. If you are participating by phone, please press *6 to mute your phone. And *5 to raise your hand on Teams. The Teams chat feature will not be available for use during the meeting.

For everyone in the room, please put all your electronic devices in silent mode and mute your laptop microphone and speakers. In addition, please keep sidebar discussions in the room to a minimum since the ceiling microphones are live, and they're actually quite sensitive.

For the presentators, your table microphones are unidirectional and you'll need to speak into the front of the microphone to be heard online. 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.

During today's meeting the Committee will consider these topics. The Regulatory Guide 3.78, Revision 0, Regarding Acceptable ASME Section XI, In-Service Inspection Code Cases for 10 CFR Part 72, increase enrichment, the second topic will be Increased Enrichment Draft Rule Language and Associated Draft Reg Guides to implement it, including Reg Guide 1.183, Revision 2.

And with that, are there any opening statements or comments from Members? If not, then let me turn the Committee's deliberations over to our Fuels, Materials and Structures Subcommittee Chair, Ron Ballinger. Ron.

MEMBER BALLINGER: Thank you, Mr. Chairman. So we had a Subcommittee meeting on this topic on the, in December, I think it was December 18th, where we got presentations from the Staff related to this new reg guide, soon to be reg guide, related to inspection requirements for dry cask storage. Dry storage casks.

And as a result of that the Committee decided that we would write a letter, but that we would not require a presentation from the Staff at this meeting that are here. And that that would be, that would be how we would proceed.

The proposed rule basically identifies a code, an ASME code case, which could be used for defining the inspection intervals of these casks with one exception. In that, instead of allowing for 20 years between inspections under certain conditions, as defined in a very, very good EPRI report, under certain conditions where you really don't have any environment where that's going to be a problem you can

extend that inspection interval to 40 years. So that's the key. And the key report, there's an EPRI document which is referenced in this proposed letter, which is the key, the key document.

So I guess the path forward, what we thought we would do is just read it in.

CHAIR KIRCHNER: Yes, sir.

MEMBER BALLINGER: And I don't know, I have a draft paper copy in front of me because my computer is frozen and Word will not open. So if we can bring it up on the screen.

(Off microphone comments.)

MEMBER BALLINGER: We ready to go?

CHAIR KIRCHNER: Yes. Go ahead, Ron.

MEMBER BALLINGER: Okay. I won't deal with the subject title and everything.

During the 722nd meeting of the Advisory Committee on Reactor Safeguards, February 5 through 7, 2025, we completed our review of Regulatory Guide 3.78, acceptable ASME Section 11, in-service inspection code cases for Title 10 of the Code of Federal Regulations 10 CFR Part 72. Our fuels, materials and structures subcommittee also reviewed this matter on December 18th, 2024. During these meetings we had the benefit of discussions with the

Nuclear Regulatory Commission Staff, Nuclear Energy Institute and the Electric Power Research Institute. We also had the benefit of reference documents.

Conclusion and recommendation. Reg Guide 1.78, Revision 0 provides methods and procedures in accordance with the American Society of Mechanical Engineers, ASME. Codes are acceptable for in-service inspection of independent spent fuel storage installation, ISFSIs, and other licensed certificate of compliance holders to comply with 10 CFR 72.42 and Part 240.

The Committee agrees that these methods and procedures are reasonable and appropriate. Number two, the reg guide should be issued.

Background and discussion. The Staff proposed to issue Reg Guide 3.78, Revision 0 that identifies methods and procedures consistent with the ASME Code that would be acceptable for in-service inspection of ISFSIs and other CoC holders related to 10 CFR 72.42 and Part 240.

The proposed reg guide specifies Section 11, code cases that would be acceptable. In particular this initial, the initial version of the proposed reg guide endorses the use of ASME code case N-860, inspection requirements and evaluation

standards for spent nuclear fuel storage and transportation containment system Section XI, Section XI, Division 1, Section XI, Division 2 with an additional allowance for a 40 year inspection interval if particular conditions are met.

ASME Code Case N-860 "provides the requirements for inspection intervals and inspection populations following both the additional inspection after entering the storage period of operation and subsequent inspections at the specified intervals." The requirements are defined based on the susceptibility of ISFSI sites, the chloride-induced stress corrosion cracking, CISCC. Which is determined using the methodology described in EPRI report, susceptibility assessment criteria for chloride-induced stress corrosion cracking of weld and stainless canisters for dry storage systems EPRI 3002005371.

The susceptibility ranking ranges from 1 to 3, very low probability of CISCC. With 7 to 10 very high susceptibility. For ISFSI sites with a chloride susceptibility of 7 below, decreases in the inspection intervals and decreases when the inspected populations are allowed, depending on the results of a screening examination described in Code Case 860,

Subarticle 2200, with the stipulation that maximum inspection interval is 20 years and the minimum inspection population is one canister per ISFSI site. However, Subarticle 2700 does not allow increases in the inspection interval or decreases in the inspection population for ISFSIs sites which have a ranking of 8 and above. 8 is highly susceptible.

The requirements of Code Case N-860 are in general agreement with the following. NUREG-1927, standard review plan for renewal of specific licensees and certificates of compliance for dry storage or spent nuclear fuel, provides guidance for the NRC safety review of renewal applications for ISFSI specific licensees and CoCs for spent fuel storage cask designs.

NUREG-2214, managing aging process and storage provides a generic technical basis for renewal of ISFSI specific licensees and CoCs for spent fuel storage cask designs. The approval of Code Case N-860 is in the proposed reg guide. Also as considered, international standards. Including IAEA SSR-4, safety of nuclear fuel cycle facilities and IAEA SSG-15, storage of spent nuclear fuel.

With regard to the required inspection intervals the approval of Code Case N-860 in the

proposed reg guides provides an alternative to the Code Case allowing an increased inspection interval beyond 20 years. Under this alternative the canister inspection interval may be increased to a maximum of 40 years provided that the ISFSI site meets both of the following site conditions below. The ISFSI site must have a CISCC susceptibility ranking of 3 of below as determined using the criteria in this EPRI document. All other requirements of the code case are satisfied.

Note that an inspection interval of 40 years coincides with the CoC time period. In other words, the Committee considering the underlying environment degradation concerns available, testing and analytical results and risk evaluations and finds that the requirements reflected in Code Case N-860, as well as the alternative inspection interval included in the proposed reg guide to be reasonable and appropriate.

Summary. Proposed reg guide provides methods and procedures in accordance with ASME code that would be acceptable for in-service inspection, ISFSIs and other license CoC holders to comply with 10 CFR Sections 72.42 and 240. The Committee agrees that these methods and procedures are reasonable and

appropriate. The reg guide should be issued. We are not requesting a formal response from the Staff to this letter report. Sincerely Walt Kirchner.

CHAIR KIRCHNER: Thank you, Ron. Members, high level comments? Not hearing anyone volunteering any major critiques, Ron.

MEMBER BALLINGER: If you wait long enough.

CHAIR KIRCHNER: Well, when we get to the word-by-word, line-by-line we'll probably have some input. What about the concludes and recommendations, could we see those, Tammy, please?

One thing we, if I remember back to the discussion after the presentations from the Staff, I know we talked about, we didn't talk about risk per se, but we talked about the overall safety of the canisters that are out there, deployed, such. I know this is focused on the reg guide, it's not an assessment of the storage sites itself. Is there any comment on risk significance warranted here? I know you've held forth on this topic in the past.

MEMBER BALLINGER: There are, on the order, and the Staff can correct me if I'm wrong, there are at least 2,000 canisters out there. Is that about right?

MR. DUNN: Darrell Dunn, NRC Division of Fuel Management. It's actually closer to 4,000.

MEMBER BALLINGER: Close to 4,000. Some of them are 20 years old.

CHAIR KIRCHNER: Right.

MEMBER BALLINGER: We've had zero leaks.

CHAIR KIRCHNER: Yes.

MEMBER BALLINGER: In welded canisters. Got to keep careful here. And the EPRI document that's referenced here really does a great job at not only discussing that but identifying the susceptibility. The risk.

CHAIR KIRCHNER: Yes. Now the reason I raised it is that this will obviously, go also up into the Commission, Commissioner Offices. And if we wanted to venture further than the reg guide and make any statement along those lines I was wondering whether that would be appropriate as part of this.

VICE CHAIR HALNON: I was wondering also if this is an opportunity to say it's a good example of operating experience, Industry, what you call the EPRI reports, but research, Industry research and a risk-informed approach to regulation where it all came together in this to establish a framework that is much more amenable to the --

MEMBER BALLINGER: I'd be happy to do that. If this is a pet peeve by the way.

VICE CHAIR HALNON: Well I was –

MEMBER BALLINGER: But I restrained myself from launching off into something that has nothing to do with the reg guide.

VICE CHAIR HALNON: Well it's more of a –

CHAIR KIRCHNER: Intentional --

VICE CHAIR HALNON: -- a comment from the standpoint of a less, acknowledging that this was a nice job, if you will, of bringing in the factors of all these experience, research and regulation, putting them together in a risk-informed way and coming out with a good product. That seems to be –

MEMBER BALLINGER: You mean as part of a conclusion?

VICE CHAIR HALNON: Either a conclusion or maybe in the summary. It doesn't necessarily, I mean, I guess it's one of the same in our letters but –

MEMBER MARTIN: You could do something simple Like, that last one is obviously pretty terse. You could just say, you reg guide to be sound, risk-informed, appropriate or release, and you sneak in risk-informed.

MEMBER BALLINGER: I'm happy to do that.

That's a good, these are good comments.

VICE CHAIR HALNON: Just kind of, just keying off of Walt's discussion. I kind of popped in my head, I was looking at the slides and it just seems Like all the things came together here. You know, the research and the operating experience and the practicality of inspections. And it just seemed to come together into a good bowl of risk-informed approach to regulations.

MEMBER BALLINGER: Yes. I mean, this would be an expansion. I'd be happy to do that. Happy, you know, happy to do that. It's not a line-by-line issue but --

VICE CHAIR HALNON: No. It also means paragraph and the letter.

MEMBER BALLINGER: Yes.

CHAIR KIRCHNER: Yes.

MEMBER BALLINGER: Yes.

VICE CHAIR HALNON: A couple lines. I mean, yes, a couple lines. And then Bob's suggestion about just mentioning it in the Number 2 there --

MEMBER BALLINGER: Yes.

VICE CHAIR HALNON: -- as a prelude to the, this reg guide should be issued --

MEMBER BALLINGER: Okay.

VICE CHAIR HALNON: -- works.

MEMBER BALLINGER: I'm happy to do that. I'll have to have a backup for this because I might not survive the next rule.

(Laughter.)

CHAIR KIRCHNER: Pardon this interruption. Would the court reporter, since we are deliberating now on the letter, we don't need a transcription of our conversation so I think, we expect --

MR. BURKHART: 10:30 So, this is Larry Burkhart. If you can come back at 10:30 for the increased enrichment topic, Toby? Toby, can you hear me? Okay, so we can stop --

COURT REPORTER: Yes, I can hear you. So this is off the record. I come back at 10:30?

MR. BURKHART: Yes. At 10:30, yes.

(Whereupon, the above-entitled matter went off the record at 8:51 a.m. and resumed at 10:38 a.m.)

CHAIR KIRCHNER: Okay, we're back in session. And we're going to turn to the topic of increased enrichment. And I will turn, once again, to Ron Ballinger.

MEMBER BALLINGER: Thank you, Mr. Chair. Well, here we are at the beginning of the beginning. Which is probably a better way to put it. We've had

multiple meetings, multiple discussions and I think they've actually been very, very good. So we're planning on writing a letter, we will be writing a letter on this but we should, Theresa, you want to say something?

MS. CLARK: I'm happy to you, if you'll allow it.

(Laughter.)

MEMBER BALLINGER: We're always happy.

MS. CLARK: My pleasure. So, hi everyone. This is Theresa Clark from the Division of Safety Systems. I've been speaking at some of these meetings. It's a slightly different audience, at least in person.

So I'll just reemphasize perhaps, for the record, how proud I am of the Staff who've been working on this. How important this role is to both the Agency and to the Industry that's looking forward to adopting it. And the obvious tensions in all of the conversations that we've had between, you know, what level of requirements are necessary in the role versus how performance-based we can be putting things in guidance, between getting the best product possible within the impressive schedule that we have set for our self. And a couple at least other intentions that

I forgot here.

But we've made our best efforts to think about and reflect on what we've heard to make some reasonable adjustments where we could to make sure that the requirements are just copy/pasted from decades that are right size to the environment that we have today. And so, we go work at sort of a lot of the beginning of the beginning team. We have a product that we think is very good to go out for public engagement, workshops and to really perfect a rule that will advance the adoption of safe technology in the country. So we look forward to that.

And as you'll be hearing, there are other things going on too outside the process of the rulemaking and we look forward to continuing those in public engagement too. So thank you for the opportunity, kudos to the Staff.

MEMBER BALLINGER: Thank you. So who is controlling what here?

MR. BENAVIDES: I guess I am at this point.

MEMBER BALLINGER: Okay.

MR. BENAVIDES: Next slide, Aaron. You know, once again, thanks for your time. I'm Phil Benavides, project manager in the Office of Nuclear

Material Safety Safeguards assigned as project manager for the rulemaking at increased enrichment of conventional accident fuel designs for light water reactors.

Today we're going to discuss the draft proposed rule. This discussion will include a brief overview and status in the increased enrichment rulemaking which will lead into brief summaries of the relevant subject matter. From the relevant subject matter experts for each technical topics. With that I'm going to provide their review.

Next slide please. As a reminder how we got to this point. I would Like to go back to the beginning when the issue was identified.

Throughout the last few years Staff has seen an increased interest from Industry for the use of fuel enriched above 5.0 weight percent uranium-235. The NRC noted that although the current regulatory framework allows for licensing of the fuel above 5.0 weight percent, the use of this fuel may result in numerous exemption requests for licensees.

So as a proposed solution NRC Staff began pursuing rulemaking rather than licensing by individual exemptions. In December 2021 the Staff provided the Commission SECY-21-0109 requesting

approval to begin the rulemaking process.

Next slide please. The Commission approved, approval was granted in the SRM, SECY-21-0109 on March of 2022. In this SRM the Commission specified several considerations to evaluate in addition to what was specified in the rulemaking plan.

One was that the rule should only apply to high assay low enriched uranium levels. This was done for both non-proliferation and safeguard reasons. And for the Staff to focus on the range of enrichment most likely to be contemplated in future applications. In addition, the Staff was directed to address fuel fragmentation relocation and dispersal and take a risk-informed approach.

Next slide please. The NRC issued a regulatory basis on September 8th, 2023. Stakeholder involvement throughout the process including public meetings which were held before the regulatory basis was issued in June of 2022 and after the regulatory basis was issued on October 25th, 2023.

The regulatory basis public comment period was open from September 8th, 2023, through January 22nd, 2024. In addition to the rulemaking engagement Staff shared fuel dispersal insights at the NRCs annual higher burn-up workshop on September 3rd, 2024.

The proposed rule is due to the Commission in March of 2025.

Next slide please. This slide shows no real rulemaking activity. We're still in the proposed rule package development stage and we're currently on our, currently at the yellow star working on our way towards submission to the Commission in March 2025.

After the Commission reviews and approves the proposed rule package the Staff will finalize the proposed rule based on Commission direction. The federal register notice will be issued opening up the proposed rule for public comment indicated by the purple box on the right.

After the public comment period closes the Staff will develop the draft final rule package which is expected to be sent to the Commission in September of 2026. I do want to point out that in addition to these ACRS engagements the draft, per the draft proposed rule, Staff plans to present to ACRS again towards the end of the final rule development period prior to the draft final rule being sent to the Commission for consideration.

Next slide please. This slide shows the order of the presentators for today. After this overview presentation we'll transition to brief

overviews on the following topics. Criticality accident requirements, fissile packaging requirements, control room design requirements and fuel fragmentation, relocation and dispersal.

I guess before we move on is there any questions on the process?

CHAIR KIRCHNER: With your best estimate schedule, when would you come back to the ACRS from that time line?

MR. BENAVIDES: Looking at the time line and, you know, we're trying to get to the Commission in September, and so probably in the summer, you know, of I guess 2026 leading, you know, before we send it up to the Commission.

CHAIR KIRCHNER: Okay. All right, thank you.

MR. BENAVIDES: Yes, you're welcome. I guess with no further questions we can move on to our first technical presenter, Charley Peabody, who is online.

MR. PEABODY: All right, thank you, Phil. Next slide please. So I'm just going to give a very brief overview of what we're doing here. We didn't get a lot of questions or feedback on, from the subcommittee because we think that this is one of the

areas that's particularly straightforward in what we're proposing to change.

What we're going to do is we're going to amend the existing 5.0 percent weight u-235 limit in 50.68(b)(7) and allow for an alternative between that existing 5.0 weight percent or a plant specific criticality safety limit which is based, which will be specified somewhere in the licensees operating license documentation. The licensees will be allowed to increased enriched fuels above 5.0 weight percent as long as the increased enrichment levels approved are specifically in their technical specifications, design features or some other equivalent part.

We chose this proposal because it, you know, based on a research study that we did we believe that the existing analyses, which were used under the other paragraphs of 50.68 can be applied to the enrichment levels that are specified without substantive changes to the methodologies. And this would just basically provide a means of getting, getting licensees able to go above 5.0 weight percent. And it will also allow licensees which do not wish to go above 5.0 percent to continue using their existing, their analyses without any particular back fit concerns that arise out of the rulemaking.

That's all I have. Any questions? Next slide. All right, hearing None --

CHAIR KIRCHNER: All right. This is Walt Kirchner --

MR. PEABODY: -- I'll turn it over to Jason. Oh, go ahead.

CHAIR KIRCHNER: Yes, Charley, before you hand it over, on the analysis methods that you have, or that the applicants are using for criticality safety, is there any, are you seeing any needs for benchmarking or anything to go up to a nominally 8.0 percent or you feel the methods are well validated? I'm thinking of NCNP and perhaps other codes that are being used.

MR. PEABODY: based on the research study that we did, we were basically utilizing Like the existing absorber, absorber methodologies. So Like adding additional absorption materials. And we, the research study showed that you can basically, you know, by expanding the amount of poisons, whether it's gadolinia or integral fuel burnable absorbers that we can still maintain the decay effective levels and the desired ranges, even all the way up to the higher end of the range of 15 to 20 percent.

So I would say that we have very high

confidence in the up to eight percent range because that would be even less than a change than the bounding cases that we did as part of the ORNL research study.

CHAIR KIRCHNER: Okay, thank you.

MR. PEABODY: All right, any additional questions? All right, I'll turn it over to Jason Piotter then.

MR. PIOTTER: Thank you, Charley. Good morning everyone. Nice to see everyone again. My name is Jason Piotter, I'm the new fuels team leader in NMSS. Former life I was a structural reviewer and a containment reviewer so that's been my role with respect to 10 CFR Part 71 packaging requirements.

The bottom line up-front for, next slide please. The bottom line up-front for transportation packages for UF6 is that the current regulations are actually adequate all the way up to 20 weight percent to certify these packages. The applicants can use 71.55(b), 71.55© and 71.55(g), in addition to exemptions, to certify their packages. And we do have certified packages currently, all the way up to 20 weight percent.

Just a reminder for folks that hadn't heard this presentation, or parts of this presentation

before, the regulations in 10 CFR Part 71 for packaging transportation of the radioactive material in general to not have an enrichment limit requirement. There is one location within 10 CFR Part 71 that does have that enrichment limit as part of the rule at 71.55(g). And it is specific only to UF6 packages.

There is a provision at, in 71.55(g) that allows an exception to the requirement that currently exists in 71.55(b) which requires the consideration of water in leakage when performing criticality evaluations. And the stipulation is, is that the UF6 content currently is not enriched to greater than 5 weight percent.

Next slide. So while our current regulations, as written, are sufficient to transport higher enriched UF6, what we're providing is a nonmandatory modification of the current enrichment limit that allows for more regulatory certainty while maintaining safety.

This rulemaking would amend 10 CFR 71.55(g) to allow the current exception of UF6 in ratio of up to 5 weight percent to expand to 10 weight percent U-235. In addition, the modified rule would require a defense-in-depth design feature for those

packages containing UF6 enriched between 5 and 10 weight percent U-235.

And again, just as a closing idea, the purpose for taking a balanced approach with this, had a bunch of various reasons for it, but primarily it had to do with, again, maintaining that we had regulatory certainty and regulatory flexibility maintained and balanced. Take that in conjunction with the fact that we can certify packages all the way up to 20 percent currently, the Staff did not feel it was warranted that we would go fully up to 20 weight percent.

We do have a question, however, out to the public to provide additional specific feedback on this point so that we get additional public and stakeholder input to this enrichment level, enrichment level that we chosen for the proposed rule. That's all I have for the presentation. Any questions?

CHAIR KIRCHNER: Jason, what would be a typical defense-in-depth measure, as you went up to 10 percent?

MR. PIOTTER: What we've seen in the past for UF6 packages, currently the rule has a performance requirement that during the hypothetical accident conditions no part of the packaging can impact the

valve. What we would expect to see is some sort of valve protection device, in addition to have a requirement where on impact you would get no part of the packaging that would get close to the valve.

So it would be an additional layer, much Like sort of a shear ring such that if got sort of a guillotine type cut or guillotine type impact it shouldn't shear that valve off. Now what this implication of this is, is that it's not technology neutral it's specific to what we know with respect to existing designs that have a valve type feature to do filling of the material.

If we were to look at something different that's where we would perhaps look at 71.55©. And if you look at and do a comparison between Golf and Charlie, I think the way that 71.55(g) has evolved is very much in the spirit of 71.55© which is looking for a special design feature. That's the language in 71.55©.

CHAIR KIRCHNER: Okay. Typically, is that Like a cap on an acetylene bottle or a hydrogen bottle?

MR. PIOTTER: I would envision that that's what that would look Like.

CHAIR KIRCHNER: A guard cap over the

valve mechanism.

MR. PIOTTER: Yes, I believe that there had been some historical cases, and I know that in Europe, I do believe, that that's a requirement for their cylinders, that they have an additional valve protection in place.

CHAIR KIRCHNER: Thank you.

MR. PIOTTER: Yes, sir.

(Pause.)

MR. PIOTTER: If there is nothing further I'll turn the next slide to Elijah.

MR. DICKSON: Good morning. This is Elijah Dickson. I'm looking forward to being here today to effectively recap several presentations we've had over the last year and a half, I supposed, on our Vogtle 2, the design control criteria GDC-19 and 10 CFR 50.67.

Just to recap some of these presentations. The thought process in approaching this rulemaking was to focus on, not only addressing some of the technical bases with the rule itself, but with updating the alternative source term to increase the applicability of its use for these operational targets, as well as updating several of the transport models that are, contained in guidance.

In recapping our presentations that we had in regards to the control room design criteria itself, we focused in three specific areas. The first, we had discussed the foundation of the Commission's policy and regulations concerning the radiation protection framework. Within this framework we are able to assess how the propose to amend the control room design criteria would be possible.

And second we discussed, to provide a general understanding of how this proposal fits within the Commission's framework and then reviewing evidence-based justifications based off of various national and international organizations responsible for radiation protection recommendations which have strong scientific and technical underpinnings.

And then lastly, with these two areas discussed we were able to proceed with developing and presenting some reasonable regulatory relief by proposing a modest increase in the control room design criteria from 5 rem to 10 rem with the flexibility of leveraging facility specific risk insights if a conditional margin is needed above 10 rem when performing a radiological consequence analysis. With that, I can take some questions.

MEMBER DIMITRIJEVIC: Hi. This is Vesna

Dimitrijevic. So we had the previous discussion about this applicability of the, you know, using the CDF as the ranking measures and we have the comments that things are maybe not connected.

But since our last meeting I actually went and read your white paper and looked at everything. And I took the serious thinking about this. And my conclusion in this moment is that this is, using CDF in this matter is not really in the spirit of risk-informed process because risk-informed means what it says. It's risk informed. But here we just use the general risk manager and, you know, try to define the ranges based on this.

The risk-informed actually looks in that if you were going to make a change what would be fewer impacting. And what type of the change is occurring. So here there is not that connection. That, what does it change in, you know, control room, the dose, which risk is impacted on this.

So there was not any attempt to define the risk because you could try to define is this risk to operator or is the risk to general public. And if it's a risk to general public then the higher dose towards that, because you want operators to stay long to take care about, you know, the business or managing

an accident progression.

So basically this would be equivalent if we say, okay, if you have a low CDF go and change inspection intervals or, you know, extend your EPZ or, you know, do flexible tech specs. That's not how it works, it has to be related, the measures have to be related to the risk.

So this is my opinion in this moment. If you know, if we have Reg Guide 1.174 maybe actually CDF, total CDF and LERF play a role on the, and allowing you to make changes where you have to define the changes in the risk.

But after reading your white paper I think it made a really good case when it comes to the performance base and therefore I don't see really need for this four, you know, ten percent to 25 percent. I think that this paper printed will allow 25 percent as an alternative without, you know, considering really CDF because CDF has nothing to do with that. And actually, the case could remain, the 25 percent is supporting CDF by allowing operators to be, you know, involved in managing accidents longer.

So, so my main comment there is that really using the CDF is the general, is such a general, is not in the spirit of risk-informed

application. That's not what risk-informed means. It's not informed on any risk. CDF is the general risk manager, you know, for a lot of things Like that. But how do we connect that to the control room dose, it's not really defined.

However, I think your white paper will support claiming the 25, using just 25 percent as alternative risk-informed. So, that's my comment on this.

CHAIR KIRCHNER: Thank you, Vesna. And if I might join in, Elijah, thank you for the background papers those were very informative.

Again, you're hearing individual member opinions. We'll get together and deliberate later, but from my perspective I thought you laid out enough, and it's up in front of us, I think to justify the 10 rem as the revised control room design criterion and 25 rem under special circumstances. So, you have a different phrase so I probably didn't get that right.

And there's a lot of literature that you site that provides ample justification for the two numbers. I had a similar problem as Vesna, I suspect. And I'll take it in a different way.

If you look at what we're doing in 10 CFR 50, 52 and 53, we are using the same dose criteria as

in Like 50.34 or 52.47. And I don't remember where it is in 53. And then the, let's think about advance reactors because they're going to come in and see this and want to use this as well for their control room design.

Typically what we've seen, so you had a fix dose that was acceptable to the public or to the operators and then if you have a plant that has a better CDF, for example, you probably also can make arguments on the lines that maybe the source term is less as well. And you take advantage of that by not changing the dose allowed, but for example, in one application that we reviewed, you've probably involved in this, we see them pulling in the EPZ versus the ten mile but the dose is still the same. So the EAB and the LTZ, they still have to make, meet the same criterion.

So I'm a little concerned as to one, what the public would make of this if we had a sliding scale of acceptable dose to our operators rather than, this is it, and design to that. And we talk amongst ourselves about this being a design objective not a target in terms of exposure. But that's subtly. I don't know how you convey that to the public well.

And so, my thinking is, if you set 10 and

25 as the limits then it's up to the applicant to demonstrate to you that they are within these design objectives. And there are lots of ways they can do that.

But it seems to me sharpening the pencil on the, even though currently we have mature PRAs that we have reasonable confidence in, we've got a lot of PRAs now, we've got a lot of operational data to back them up, we have a lot of equipment reliability data to back them up. We're not going to see that advance reactor applications.

So the uncertainty bands that we're going to see, certainly with advance reactor PRAs, in my estimation, are going to be much broader than what our confidence is in the current fleet. So I'm just concerned, one, the optics to the public having the sliding scale of "acceptable dose," that's not what we intend but it's the design objective.

And then banking that on a estimate of CDF. Here I align with Vesna, I think LERF is probably more relevant to the question at hand. But then I also think through, I'm trying to think through, what will the operating plants do, will they sharpen their pencils or will they actually go and redesign the control room to provide more shielding,

better filter, better ventilation, whatever their options are. They're not going to move the control rooms they're fixed sites now and so on.

So I get, from your perspective of incentivizing better performance through the use of the risk metrics, but I think from a practical pragmatic standpoint I don't think it works. But that's just one members opinion.

I think it's going to be very difficult to convince the public that there should be a sliding scale on acceptable dose because they're going to read it Like, oh, okay, the operators could have a higher dose because they have a lower CDF. But that is a, in my estimation, a tough, a tough sales job.

But you have provided ample justification for just going with the 10 and 25 as you have on the slide before us. So I'll stop there. And again, that's not the Chair's opinion that's one Member's opinion.

MEMBER BIER: Yes, this is Vicki Bier. Following up on that. I think there is potentially a rationale for doing that that may the level of protection that we owe the operators is lower if the chance of every encountering such a situation is extremely small. But that also wasn't really

articulated in the document.

There may have been a lot of thought process that went into that determination, but if you do want to take that perspective I think, you know, I would agree with Walt, you need to think about how its conveyed and, you know, how to justify why that's reasonable. I thought about it a fair bit and couldn't decide for myself which way I Like better, but --

VICE CHAIR HALNON: This is Greg. I can talk from a non-practitioner, more from an operations perspective, and it means nothing to me from the standpoint of, when I enter the control room in the morning whether or not you tell me the design of the control room is 10 or 25 rem. I know that my occupational limits apply. I know that my emergency plan states what I can and can't get. I know that I'll be relieved at a time based on what's happening, and I know that this is the design space.

Now, from a member of public, if you understand the difference between CDF and LERF you probably could understand the difference between design criteria and dose, occupational dose. And in fact, the only time this probably will be used in the operating fleet is when you need a AUD or some other

type of relief from a regulatory problem based on text, charcoal, HEPA test or whatever the case may be that your design is efficient and you have increased leakage or lacks efficiency or whatever the case may be, you would probably use it for a short period of time and do a calculation to justify something.

Now, to the newer sites, the advance reactors, we're talking much lower CDFs, if it even applies, given the length of fuel. You may be seeing, so maybe LERF may be more appropriate for some of the reactor types. But the bottom line is, from a layman's perspective, if you give me a safe plant I have less of an opportunity or less of a probability of having reactions that could cause the problem, I'm going to feel more comfortable with a looser design based on that.

And so I'll just give you that. It works for me because operating this you got safe plant, you're going to tell me that now it's, and I know it's a terrible word, but it's safer, better, less probability, less risk, and I'm going to feel more comfortable with it. So again, from the layman's perspective, on my side it works fine for both existing and the advance reactors.

MEMBER ROBERTS: This is Tom. Following

up on all of that, I think the key on what Vesna's point is, is the severe accident risk. And does this change to the design criteria, change the severe action of risk. And I think those are two separate questions. That if you were to have a five times leaker control room because your design criteria went up by a factor of five, and maybe you are affected to severe action of risk and now need to be evaluated.

It's also important to note that the reg guide revision is still going to require assessing any design change that's consequence, potential consequence with severe accident performance. So maintain that as part of the guidance requires the applicant to consider whether or not what they're doing would effect severe accident risk. I think its important to keep in mind those are two different questions that both need to be addressed.

So I don't know if that helps out with Vesna's concern but I think it is important that any design changed enabled by this rule change would require great assessment for the PRA parameters of, is it effective severe accident risk.

CHAIR KIRCHNER: Well we get into this problem by assuming a maximum hypothetical accident and a source term with it. So that's --

MEMBER ROBERTS: And that MHA is not, really the maximum hypothetical because it makes an assumption as part of the design criteria. And so a severe accident could significantly exceed those doses. So that's part of what a severe accident assessment or a PRA is supposed to look at.

CONSULTANT SCHULTZ: Elijah, this is Steve Schultz. I think what you've done in your paper, in both papers obviously, clearly, the discussions and the evaluation of the appropriate dose criteria that could be used, and are used, internationally and now nationally with this, this improvement, both of them are excellent pieces of work. And so the question that, bringing up here is the metric of CDF as it applies to the application of extending the dose beyond 10 rem TEDE.

I think this is an area where, I don't know exactly how you presented going forward in the draft rule going to a final rule, but it is an area where further discussions with Industry would be very helpful because the metric associated with the evaluation, and then plant safety and its effect, if you will, on operators. The operators have a lot of opportunity to control accidents and to prevent severe accidents and so forth. We've seen that.

The plants have made a lot of improvements associated with preventing accidents, and of course, severe accidents. Thinking of Davis-Besse, thinking of Fukushima and lessons learned that Industry and the NRC have really addressed in the last 20 years.

So I think there are some opportunities here for further discussions trying to pinpoint how one could move forward with a risk-informed performance-based approach. Maybe twists some metrics that are used to move forward if in fact that incentive is needed to determine the need for a larger control room dose as part of the design.

As Walter said, you have the design approach with regard to the control room and then you have the allowance and ability for the operator to stay in the control room, do work that's associated with severe accident prevention or response. So, just a comment.

Excellent work has been done as Theresa had said at the beginning. The Staff has done excellent work in these areas and really should be congratulated. And I hope the Commission sees that and recommends that you move forward with this piece of it and the overall rule application. I'm expecting that's going to happen.

MEMBER DIMITRIJEVIC: My point in this discussion was a little bit more general in terms of the risk matrix. It's not that risk matrix is at risk which is impacted by this. So by using CDF we want to say does a TEDE impact CDF? Does it make any change in CDF?

We don't really have that connection. So we are using a general, you know, CDF and LERF, which are the prime hazards, and it's calculated to connect it to something where we don't see the connection. So it's not the risk-informed. To be risk-informed it has to be the right risk.

As I said, we have many risk-informed applications who eventually working in Industry. So None of them says, as I said before, if you have allowed CDF, go ahead and use that, you know, the flexible tech specs. No, it says, check out how does these tech, specific tech specs impact your CDF. It doesn't say, A, if you have a low CDF go ahead and take your diesel generators out for two weeks. You have to calculate risk associated with that.

So that's my sort of objective that this is not in the spirit of risk-informed application. However, if you can make a case, the 25 rem, it will allow the operators to have an accident in the longer

time. That would be some risk argument, so.

CONSULTANT SCHULTZ: I agree with your point Vesna, especially the latter. The last one you've made. This is Steve.

CHAIR KIRCHNER: So Elijah. Do you have more slides?

MR. DICKSON: I think that's all I had.

CHAIR KIRCHNER: Okay. Thank you.

MR. DICKSON: Other than questions. Yes.

CHAIR KIRCHNER: Yes. We thank you.

MR. DICKSON: Yes.

MR. MESSINA: Hi. So I'm Joe Messina from the Nuclear Methods and Fuel Analysis Branch of NRR and I'm going to talk about how we're addressing FFRD with 10 CFR 50.46(a).

Next slide please. So in this rulemaking we are, we are proposing a voluntary alternative to 50.46 to re-categorize large break LOCAs as beyond design basis accident. Specifically LOCAs above a transition break size as beyond design basis accident. The smaller breaks would be treated as they currently are under 50.46 requiring high probability, which has been interpreted at 95-95 to date. And breaks above the transition break size would be, allowed to be relaxed. So they could use best estimate modeling an

more realistic assumptions based on their lower likelihood of occurrence.

And we leveraged a lot of what was done in the 10 CFR 50.46(a) rulemaking in the early 2000s which went to the Commission as a direct final rule in 2010 but was ultimately rescinded after Fukushima.

Next slide please. So how does this address fuel dispersal? So we think it, we believe it addresses fuel dispersal in its coolability. So while it, we don't have significantly different words in the rule language on coolability we clarify in the preamble or statements of consideration that coolability is not necessarily in conflict with dispersal. Some amount of dispersed fuel can be shown to possibly remain coolable and safe during a LOCA so therefore it could be acceptable to have a predicted occurrence.

And we expect that true best estimate modeling and realistic assumptions would significantly reduce or even eliminate the calculated potential for fuel dispersal. But if fuel dispersal does occur there is some high level guidance on analyzing the consequences of fuel dispersal in DG-1434.

And while this approach does not physically address potentially non-mechanistic

approaches to evaluating FFRD, such as those described in other alternatives in the regulatory basis, such as Alternative 4 or modified Alternative 5. Although licensing pathways exist, such as the topical report process, and we anticipate that the performance-based criteria in the rule would facilitate these, an avenue for these alternatives in the future.

Next slide please. So I want to highlight some of the changes that we made since the January Subcommittee meeting. There are three ones, three changes on this slide.

And so, originally we discussed how there is a requirement in 50.46(a), the rule language to inspect ten percent of similar metal welds on piping larger than the traditional break size. Based on the discussions in the Subcommittee we have replaced the requirement for ten percent of similar metal welds to an approved, NRC approved sampling of similar metal welds. And we've made corresponding changes in the DG-1428 on plant specific applicability of the transition break size.

Additionally, in the definition of transition break size we added that green underlined text there that allows for a plant specific alternative break area to be, to adjust it. So

licensees, current operating plants, if something causes them not to agree with our transition break size, or we believe that their transition break size should be a larger, they can propose their own plant specific transition break size.

And then we also added a little bit of clarification on alternative approaches in the preamble and SECY paper on kind of what I discussed previously. That the performance-based view of coolability, and the fact that fuel dispersal is not necessarily incompatible with coolability can facilitate alternative approaches such as those suggested in Alternatives 4 and 5. And we would plan to have further interactions with Industry on other potential alternatives via interactions such as workshops.

Next slide please. So I wanted to provide a relatively high-level overview of the requirements of 50.46(a). So I mentioned the weld inspections. On similar metal welds above the transition break size.

They would have to demonstrate plant specific applicability of the transition break size, make sure that any changes made do not invalidate the transition break size. They should have a risk-informed evaluation process to analyze changes enabled

by 50.46(a). And the criteria for that would be that changes must be kept to a very small risk increases. So those CDF and LERF metrics are on this screen. And that the overall risk must remain small.

Establishes two principle ECCS performance criteria maintaining fuel coolability and long-term cooling. And then as four, fuel performance criteria, addressing cladding degradation phenomena, maintaining fuel coolability, avoiding explosive concentration of combustible gas and long-term core.

And then these last two bullets talk about the differentiation in the breaks. So break, transition break size would still require high probability that the criteria are met, just as they are today. And then breaks above the transition break size must be met to at least a best estimate level.

Next slide please. I created this graphic to potentially help see how some of the rule language maps into the guidance. So you'll see that we have a DG on plant specific applicability of the transition break size which help to address those few things in the rule on the left. DG-1426 establishes criterion guidance for the risk-informed evaluation process.

And then for the fuel performance criteria we have these four DGs. The first three, DG-1261

through 1263, were from 50.46(a), 50.46© rulemaking in 2016 that we've updated a bit. And then the last one I had mentioned before was DG-1434, addressing the consequences of fuel dispersal.

Next slide please. So I wanted to have a few, I have a few extra slides on some of the topics that we dove completely into in the December and January subcommittee meetings. I'll go quickly through them, but one of the major topics was the transition break size and how it was developed.

So, in the originally 50.46(a) rule there was a lot of work done to establish LOCA break frequencies in NUREG-1829. And then they also addressed seismic risk in NUREG-1903. And these were used to develop a transition break size which was, which was established based on the frequencies, as well as other considerations such as uncertainty, as well as making sure that there are just regulatory stability.

And then in this current rulemaking effort we've done work to reconfirm it since that work was done basically 20 years ago. So we've reconfirmed NUREG-1829 with a number of studies. We did internal, external elicitations. We've looked at recent operational experience. We've done some XLPR

probabilistic fraction mechanics calculations. And we've looked at international operational experience in the database.

We've also reconfirmed NUREG-1903 by evaluating flawed piping failure, indirect piping failure and component piping failure. So there was work done, but for the flawed and indirect failures it was established that more plant specific analysis would be needed to confirm. But for the unflawed failure we found that failure probability was significantly low compared to the one times ten to the negative fifth review frequency used as the basis to establish a transition break size.

Now, overall with this we were able to confirm that the transition break size was applicable as long as a plant specific applicability issue.

Next slide please.

CHAIR KIRCHNER: Joe, before you go on. On the 1903 confirmation, so what I understand the Industry feedback that you've had so far, and what we've heard, one of the issues they're having is the need I think to go back and do a rather complete re-analysis from the seismic standpoint of their NSSS systems. Where do you see this playing out when you implement the proposed rule? How much can they fall

back on the post-Fukushima analysis to address the seismic aspect because specifically one of those sub-bullets there under the 1903 confirmation?

MR. MESSINA: Yeah, I'll point to Dave Rudland. Staff.

MR. RUDLAND: Hi, I'm Dave Rudland from the Staff. Yeah, the confirmatory work that we did took the most recent seismic hazard curves after the Fukushima accident developed and confirmed that the results that we had in the original 1903 were still valid. And in the analysis, but the analysis that we did was not bounded for the fleet and so that's why the plant-specific applicability is needed.

And what we did was he leveraged, plants are able to leverage these inspections that Joe talked about to eliminate –

MR. MESSINA: Right.

MR. RUDLAND: -- those particular analyses.

CHAIR KIRCHNER: Okay. It's hard for us to sort out hearing both sides of this. It sounds Like, from the Industry perspective, it's a considerable burden.

MR. RUDLAND: Again, if they do the inspections there is no additional analysis needed.

And if they don't do the, after the inspections are part of the requirements of approval.

CHAIR KIRCHNER: Right.

MR. RUDLAND: They can just leverage those as long as they, the critical welds that they're analyzing are in the inspection curve. Okay?

CHAIR KIRCHNER: Go ahead, Joe.

MR. MESSINA: Thanks. Next slide please. So there was a bunch of discussion on the clad testing, DG. So DG-1261 through 1263 in the previous Subcommittee meetings. DG-1261 addresses breakaway oxidation and how experimental, experiments could be done to address this and how initial testing and periodic confirmatory testing should be performed. DG-1262 defines experimental technique for determining post-quench ductility, establishing ductility transition for zirconium-alloy material.

And then DG-1263 establishes limits to address zirconium-alloy cladding degradation phenomena. So it establishes post-quench ductility and breakaway oxidation as well as has a PCT limit and a limit on the metal combustible gas. It also provides cladding hydrogen uptick models as well as providing guidance to consider the impacts of oxygen diffusion from the inner surfaces of the cladding.

Next slide please.

CHAIR KIRCHNER: Before you go on. The breakaway oxidation seems, that seems to generate some feedback.

MR. MESSINA: Yes.

CHAIR KIRCHNER: Okay. So what is an effective way to look at this problem? For the current, I shouldn't say current. What would be, you know, for recent reloads using advance claddings at different types this doesn't seem to be an issue. Is there a way that, from the advance cladding materials that you've already reviewed that this one could be cast aside, so to speak, based on experience with some of the more recent cladding types that, I'm trying to stay out of proprietary nomenclature on all the rest so I'm not doing well.

But, you know, recent zircaloy clads don't exhibit this behavior. Is there a way that you can determine that in advance so to speak by demonstrated performance to date, existing manufacturing processes?

MR. MESSINA: So I think the challenge lies in that, you know, small changes in allow composition, manufacturing processes could be to breakaway, unexpected breakaway oxidation. So, but I'll point to James Corson who wrote the DG.

MR. CORSON: Yes, James Corson from the Staff in the Office of Research. So the first thing I'll say is that all cladding alloys will exhibit some breakaway oxidation behavior eventually. But it's not going to be as severe as what we saw with Like U-110.

When we look at the more modern alloys, breakaway times are 3,000, 4,000, 5,000 seconds. And it's not Like the flaking off the oxide, the really bad visual behavior that you see, but it is characterized by a increase in the oxidation rate and an increase in the hydrogen pickup rate. So eventually cladding alloys will reach a breakaway oxidation time.

I think a lot of the consideration is, how much, or if any, periodic testing is required. And so, way back in 50.46©, early days, we had pretty strict requirements for testing frequency. They were relaxed a little bit in the final rule, draft final rule, 50.46©. We removed the testing requirements from the rule language here but the guide of course still talks about periodic testing.

So I think that's where a lot of the consternation lies. And that's something we will take a look at going forward. But I do think there needs to be some sort of limit and for a completely new

allow, at least some initial testing to verify that your breakaway time is 4,000, 5,000 seconds and not a hundred seconds or so Like we saw with U-110. So I hope that helps.

CHAIR KIRCHNER: Thank you. Go ahead, Joe.

MR. MESSINA: Next slide please. And this is my last slide. So there was a lot of discussion of what do we mean by best estimate or true best estimate as I used throughout the FRN a bit to distinguish from the traditional best estimate plus uncertainty towards the example that's described in Reg Guide 1.157.

So we, there is a lot of discussion on this. We meant to be consistent with what is permitted in other beyond design basis accidents, such as ATWS and station blackout. And, you know, we stated phenomenal inputs without consideration of conservative biases and adding all these uncertainties.

But we still acknowledge that there is some ambiguity to what this means, so we would plan to work with Industry on clarifying a definition of best estimate that we can both live with. And potentially, if a guidance document is needed, we could consider doing that too.

CONSULTANT SCHULTZ: Joe, this is Steve Schultz. In the definition of true best estimate, again, going back to what the NRC and the Industry, both separately and together did in response to Fukushima, which was a considerable effort in terms of equipment, of access, availability, development, operator training, response to mitigate severe accidents and stuff, is there an opportunity to include that in the true best estimate evaluation? The equipment that's available for the operators to mitigate any accident.

I understand to keep in line with ATWS and SBO, bit those are different accidents than other --

MR. MESSINA: Yes.

CONSULTANT SCHULTZ: -- severe accidents. More time might be available.

I'm also think that both Industry and the Staff would be interested in looking at, once one defines true best estimate, what is the result, not only for the large-break but also for small-break LOCA?

I understand that there's differences in likelihood of the event and so forth, but what is the result if one first defines what true best estimate is and then applies it across the board to small-break

LOCA, and perhaps even other accidents? I think it will be very useful to gain that appreciation.

MR. MESSINA: Yes, good point. Thank you. And I do believe they would be able to leverage some of the stuff done post-Fukushima. For example, operator actions would be able to be credited, and non-safety related equipment would be able to be credited for these LOCAs.

CONSULTANT SCHULTZ: Good. Thank you. Again, excellent work has been done in this area. I really encourage you to continue.

MR. MESSINA: Thank you.

MEMBER MARTIN: This is Bob Martin. Of course we talked about this during the Subcommittee and I can't help myself but to reiterate, there is plenty of historical precedent even in severe accidents, SECY-90-16, SECy-93-87, as they related to advance light water reactors and severe accidents. There is statements in effect of how uncertainties must be addressed.

The uncertainties particular for such events, and now we're going to call large-break LOCA, you know, beyond design basis. There is no, you know, no exception to that one either.

Crediting certain non-safety equipment,

you know, to the extent where you put evaluated the uncertainties. Maybe some of the, you know, the true risks. You know, that's certainly a plausible type strategy.

But, you know, where I'm bothered by is the word true. I mean, and that just leads to a lot of different interpretations. But whether we're talking 95-95 or 90-95 or something Like that, I mean, that is still somewhat debatable. But the language in the regulation is still something along the lines of, you know, high probability of protection or something Like that. And that should definitely remain.

(Laughter.)

VICE CHAIR HALNON: Joe, this is Greg. Several times we've mentioned the TRE review of the ALS. Are you able to share a status of where you're at with that and whether or not you see a path forward to that and is that going well?

MR. MESSINA: I'll point this over to my management.

(Laughter.)

MR. KREPEL: Hi. This is Scott Krepel, through a sign language interpreter, the Branch Chief of the Nuclear Methods and Fuel Analysis Branch.

I will say that basically there are four

different topical reports that we are working through, and we can draw up them if there's time. We did finish an audit on two of them, and so far it does seem Like things have been going pretty well, but I don't know what the result is yet, so we will be finding out at the end of the year. Stay tuned.

VICE CHAIR HALNON: So the end of the year of 2025 is when you expect to give the next status I take it?

MR. KREPEL: Roughly, yes. That is roughly the time frame that we do expect to have the safety evaluation written up.

(Simultaneous speaking.)

VICE CHAIR HALNON: Thank you.

MR. KREPEL: Yeah. So just checking with Dave Rudland there. So, yes, we haven't identified any roadblocks as of yet.

VICE CHAIR HALNON: Thank you.

MEMBER BALLINGER: This is Ron Ballinger then. Given the time scale for this analysis is that in time to effect this rulemaking?

MR. MESSINA: To effect the rulemaking?

MEMBER BALLINGER: Well, wrong word.

(Simultaneous speaking.)

MR. MESSINA: Well, we're not exactly

incorporating that into the rule, so --

MEMBER BALLINGER: Yeah.

MR. MESSINA: But Did Scott want to –

MS. CLARK: Theresa wanted to.

MR. MESSINA: Oh, sorry.

MS. CLARK: So this is along the lines of what Joe was saying in his slides about other things that are going on in parallel that are facilitated by the rulemaking.

So one of the things that we want to explore when we put this out for public comment is to make sure that nothing in the rule impedes these alternative approaches.

You know, we have these different performance-based requirements that we think would fit really well with some of these other alternative approaches, but we haven't yet found it necessary to implement the rule in order to address these alternative approaches.

So Like we're reviewing ALS right now under the current regulations. It might be facilitated and perhaps easier to document when a safety evaluation of the regulation is completed with these performance-based requirements, but that's going on now under the currently regulatory structure.

So we don't really want to disrupt that ongoing process and, similarly, we intend to be talking about Alternative 4, which, again, could be facilitated by the requirements, but we plan to talk about that outside of the rulemaking process.

So it's sort of -- If we find out through public comment that there needs to be adjustments to the rule to help with these other things, if there is insights from these ongoing parallel efforts that we want to roll into the rule, of course we would think about that, but right now they are going down parallel tracks.

We don't think they interfere with each other but we're trying to keep our ears open for any intimate interference.

VICE CHAIR HALNON: Okay. Thank you.

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

CONSULTANT SCHULTZ: Do you want more questions?

(Laughter.)

CHAIR KIRCHNER: Joe, have you and your colleagues thought through applicant comes in with a "best estimate," but let's assume that definition is worked out to both parties understand what the

boundaries are on best estimate, and you have fuel dispersal?

None of the codes that I am familiar with really can handle that phenomenon well. You are not going to have an experimental dataset to benchmark them against. That would be extraordinarily costly and take many years.

So how do you avoid once you get into the dispersal regime, significant dispersal, large amounts, and that is the next question, obviously, what defines large amount of, what is an acceptable amount of fuel dispersal? It's a different way to think of it.

The codes -- Maybe I'll turn to my colleague Scott and ask to be proven wrong, but I cannot think of a code that would pass muster for an evaluation method for LOCA that really can handle that kind of phenomena that's currently accepted by the Staff.

So what happens when someone comes in and tries to gather an argument, well, this much fuel dispersal is acceptable and I think I know it's, maybe it's in the bottom of the vessel, but maybe it's in the ECCS system by being, or maybe it's out in the containment somewhere, how do you bound this kind of

problem once you go over that threshold with significant fuel dispersal?

How would you see that playing out between yourselves and an applicant?

MR. MESSINA: I think based on the current state of knowledge most Industry would probably elect to go with a note first criterion for fuel rods susceptible to FFRD and maybe they continue to do experimental research to try and improve their codes to analyze this.

We are working with the Office of Research to try and get a better idea of what amount could be acceptable with our current state of knowledge and current codes. That work is ongoing.

The PIRT that we, the PIRT panel that we sponsored, they believed that bounding, that the current methods could be used to perform bounding calculations of fuel dispersal.

So it's possible that they could do something, bound to current scenarios, maybe, you know, bounding blockage of the grids or whatnot, so --

MEMBER BALLINGER: But without confirmatory experimental work, that's a tough one, a very tough one.

CHAIR KIRCHNER: I'm thinking of GSI-191.

MEMBER BALLINGER: Yeah, that's what I was going to say, what a nightmare that was.

CHAIR KIRCHNER: And the fact that, you know, they're -- So not fuel, but you have debris and then you're looking at blockage and such and you get into, wow, it's a difficult space.

Really you find yourself with paralysis by analysis, you know. If the applicant presents you something, you go to research and research does their analysis or, you know -- And I get the idea of trying to bound it, but there is so much uncertainty in a different sense than when we talk about evaluation model codes uncertainty.

I mean the uncertainty – Once physical, you know, once the physical structure is lost the uncertainty space just -- And complexity is a better word, actually. The space complexity grows exponentially and the uncertainty on all that is very, very large.

So how do we see the Agency dealing with this if someone says, well, it's okay to have, I'll pick a number, 10 percent of the fuel dispersed throughout the system somewhere but we don't know where it is.

Coolability I think, as we talked about I

think, you know, TMI demonstrated coolability, so that's not an issue but where is it and et cetera. So any thoughts?

You gave a good answer, obviously, if it's a no burst type of criterion as the figure narrative then life is exponentially easier.

MR. MESSINA: Yeah. We are continuing to look into it. I don't think I can say much more. We don't really want to end up in that analysis paralysis spot, which is part of the reason why we pursued this rulemaking in the first place –

CHAIR KIRCHNER: All right.

MR. MESSINA: -- because we thought, you know, with the current rule and high probability it would just be probably inconceivable in the next, yeah, five years for anyone to do anything with high burn-up. So that's part of the reason, yeah.

CHAIR KIRCHNER: Sure, yeah. No, the motivations are clear to move forward, but some of the problems that might ensue may prove intractable in the regulatory process.

(Simultaneous speaking.)

CHAIR KIRCHNER: Go ahead, Scott.

MEMBER PALMTAG: This is Scott Palmtag. I agree with you completely, Walt. Some of the things

I brought up before, other things I've heard, everyone is kind of focused on coolability, but you might want to think about unintended consequences, right, we have.

Coolability is important, of course, to keep in mind, but if you have this dispersed to your fuel, I'm just thinking of the cleanup processes, the doses, where would this go, is it stuck in the steam generators, and just huge safety implications.

Don't limit yourself just to the coolability. I think there is a lot of other things and if you start thinking about all these other situations, the doses, the cleaning this up, I would personally recommend, you know, no burst criteria.

Then, also, historically we've got the comments from the public. Ron, you know the name better than I do, but, you know, the original peak clad temperatures were based on a no burst criteria.

So I think historically by allowing burst is a huge regulatory change and I'm personally against that as well.

MR. MESSINA: Well I'll say in the current regulatory framework we do allow burst. We needed burst.

(Simultaneous speaking.)

MEMBER PALMTAG: Yes. I'm sorry, yeah, dispersion I guess is the –

MR. MESSINA: Yes, dispersion.

MEMBER PALMTAG: -- better word. Thank you.

MEMBER BALLINGER: But that's a -- This issue has tentacles into other areas where you do allow fuel failure, so you do really need to be careful that at a high burn-up if we allow fuel failure for a rod injection accident or something Like that now we're still having to deal with dispersal.

MEMBER PETTI: Let me just say we still have Industry. I mean some of us have a hard stop at noon hand, so it would be good to try to get Industry in before, but I haven't heard anything here that isn't already touched in the letter –

MEMBER BALLINGER: Oh, yeah.

MEMBER PETTI: -- that diversifies this, yeah, I think. It's just confirmation.

MEMBER BALLINGER: And we are dangerously close –

(Simultaneous speaking.)

MEMBER BALLINGER: Well, we're not just dangerously close, we're beyond.

CHAIR KIRCHNER: Well let's have the

Industry presentation and we can over it.

MEMBER BALLINGER: Yeah, that's what I was going to –

CHAIR KIRCHNER: We have flexibility in our lunchtime maybe to start –

(Simultaneous speaking.)

CHAIR KIRCHNER: So let's hear from the Industry first.

(Simultaneous speaking.)

CHAIR KIRCHNER: Thank you. The agenda says 12:15, so --

MEMBER BALLINGER: Yeah, I would invite --

(Simultaneous speaking.)

MR. BURKHART: Chair, this is Larry Burkhart from the ACRS Staff. If we need to go later than noon in light of the other meetings that have to take place is acceptable to start, to delay the start of the afternoon session if we have to and just make the appropriate announcement.

CHAIR KIRCHNER: Yeah.

MEMBER BALLINGER: Who is going to do it? Oh, Al.

CHAIR KIRCHNER: Al is.

(Pause.)

MR. CSONTOS: We have lots of slides. The

cover slide.

CHAIR KIRCHNER: Okay, go ahead, Al.

MR. CSONTOS: All right.

CHAIR KIRCHNER: The floor is yours.

MR. CSONTOS: Thank you. So, as you know, we're really not going to deviate much from what we presented back in the January meeting and, also, back in the December meetings. Much of it is very similar.

Next slide. So you know this, we have LERs coming in, both advanced fuels and power uprates. Really the -- I just came from EPRI meetings this week, the Nuclear Power Council Meetings, and we're seeing more and more interest in uprates.

The schedule, again, to reiterate, it's really, really vital to keep that. I was talking to Member Schultz here, or Consultant Schultz now. You know, what we have done in a lot of the workshops with Reg Guide 1.183 and also just the dialogue that we've had here has been what can we do in the time frame.

(Simultaneous speaking.)

CHAIR KIRCHNER: Hang on. We've got someone -- Please if you are listening in mute your microphone. Thank you. Go ahead, Al.

MR. CSONTOS: Okay. So a lot of what we have done and a lot of the discussion, the dialogue

we've had with the Staff, has been what is achievable within the time frames for the rulemaking.

So I know you've had a lot of discussion about Elijah's, you know, the dose criteria and the sliding scale. There are some things in there that we were looking into what could be done in the future.

For example, looking at CDF and LERF and looking at changes that we could make and crediting operator actions, crediting -- A lot of things that we've gained in knowledge space from Fukushima.

We knew we could not get there in this time frame so we punted that to a future topical or something along those lines. So that's where, you know, we were working with the Staff to understand what is achievable now versus what we have to think about in the future, okay.

So everything we're talking about here was with that mind set, okay. So, anyway, we think that the draft rule has a lot of positives, okay, but we also have our feedback.

You have these two letters we talked about last time. They were -- They still remain relevant to what our positions are and we really would Like for you to go ahead and send this draft IE rule up to the Commission for their review and not hold it up based

on some of the concerns that we're about to talk about, okay.

We did have alignment with the Staff and the management with workshops in the future to discuss some of these areas of concern. What we would Like to say is also there is this idea of the ADVANCE Act, you know.

We really need this rule, proposed rule, to be efficient and that's really the aim of the ADVANCE Act. We really need it to be modernized. I know we have this 50.46(a) rule from 2010, okay, there is a lot of aspects in there.

We're not asking for, I don't think, a lot, but just to modernize it to the current standards. You are going to hear a lot about that, and so that's why we say a modern risk-informed and efficient rule, okay, in line with the ADVANCE Act. It's not there just for talking points. It's really there to be more efficient.

If we don't have the efficiency you're not going to see the amount of applications coming in and changes to -- And that was the graphic in the beginning of the slide deck shows it for a carbon-free future, okay.

Next slide. So, again, I'll just go over,

you know, Jason had a great presentation this morning talking about the existing UF6 packages to ship to up to 10 percent with the small modifications that we are talking about here.

That was a big deal. That is a really big deal for us having the transportation and logistics assets to be able to ship LEU+, okay. Allowing LEU+ is also a huge improvement.

The control room dose criteria, we believe that's a very big improvement, okay. You know, can we get a little better there, possibly in the future, to credit some of those operator actions I talked about that we learned a lot from during the Fukushima event and the post-Fukushima rules.

So Reg Guide 1.183 we have two I believe pre-submittal meetings this quarter from two utilities, two PWRs, who are using REV-1. We have multiple utilities coming in and thinking about how they're going to use REV-2 once it's in this rule.

I particularly have had conversations with utilities who are waiting for when it becomes a draft version, fully up to the Commission it gets out, so they can start putting their development of their package to NRC on REV-2, using REV-2, okay. So that is where we are using the experience that we learned

out of the workshops to then put forth here and the IE rulemaking workshops.

This one down here, large-break LOCA is beyond design basis. That is big. I think that is recognition of the fact that really the risk significance and comparison to other postulated accidents of what the real risk is for large-break LOCA, okay.

We believe there is a lot more room there to build on, but openness to this concept is a big deal, okay.

The last bullet, you heard that today in terms of going up to the 10 percent. But, again, there are particular aspects that you heard even during the discussion today that remain deterministic and prescriptive, you know.

We really need to think about what those requirements are, or the proposed requirements are, and the additional burdens that are associated with that, associated with the risk to the public health and safety, okay.

That's where the delta CDF and delta LERF, you know, taking some of those requirements or those prescriptive requirements and try to transfer them into, Like comparing them to what the ask is versus

what the benefit would be to the public. We haven't seen that yet, okay.

Next slide. I don't want to delve too much into this, but, you know, really the 24-month cycle is something that many PWRs are going after right now and the more I go to these meetings with Industry the more I see more and more PWRs embracing 24-month cycles.

We are, Like I said, there are applications in-house now going for 24-month cycles for four PWRs, I believe, and we have more coming, okay, and there are several more in terms of power uprates.

Next slide. That's where -- I think you heard it at the last meeting, we had four utilities come in and talk about what they are interests are. Jim is here to represent those types of questions and comments as well.

You know, just in the last couple weeks, I think this number is low now. I think we're actually going to be higher than this by a considerable amount, okay, because I heard from two other utilities who are now looking to do this, okay.

So, again, you know, let me give this background. A year and a half ago we had this survey

done and it was less than 50 percent and about two gigawatts electric, okay, a year, year and a half ago in terms of the first survey.

The second survey came out last fall and it came out to 70 percent of the sites with three gigawatts electric. I believe you are going to see more than that in the -- If we did a survey today or if we do it again, we will do it again this fall, and I believe you are going to see it even grow bigger than that, okay.

And this is incentivized by the IRA and really by the ADVANCE Act, okay. One goes this with the other in terms of trying to generate more carbon-free electricity.

Now the power up for the 24-month cycles, the risk-informed LOCA, there is a lot of folks who were here back in 2010, saw the risk-informed 50.46(a), and had the same kinds of concerns over the implementation back then as they have today.

So this number in terms of nearly 50 percent of the sites are looking for the extended fuel cycles and risk-informed LOCA are seeing a lot fewer interest in the risk-informed LOCA now because of the uncertainty associated with it.

Would that number increase? Yes. There

would be more interest in risk-informed LOCA, however, again, it's about implementation.

Next slide. That's where our prioritized concerns are, okay. So our concerns, I've broken them down here, but last time we talked about four different areas. We're going to talk about the four different areas, but I want to bring up the ones in prioritized sequence here.

Everything rolls up to implementation, okay, and so our real concern is similar to what happened in 2010 and why you're seeing less interest in the risk-informed LOCA aspects of implementation of that by the utilities.

Because of the burden that was there back in 2010 there seems to be more burden than now on the 50.46(a) piece as well as just, it's just not, the squeeze is too, is more than the benefits are there for, okay, and that's what was written back then and is more so today, okay.

So we really think that there needs to be a consideration to the improvements because a lot of things changes since 2010. A lot of things have changed.

So, therefore, we are looking at a lot of the duplication for the additional requirements that

were really contrary to the things Like in Reg Guide 1.200, Reg Guide 1.174, the requirements are there.

We have had multiple revisions of those since 2010 and so, therefore, we would Like to see the requirements that are associated with them to be in line with the modern approaches of 1.200 and 1.174.

So these are the types of things that we are talking about, the seismic issues, we've heard about 1903, you know. Is it in line with what the past 2010 rule and plant-specific requirements versus what was done for DG-14, or, sorry, for the 50.54 order after Fukushima related to the seismic issue, so I just want to go over that.

I think this is where I would Like to end it, but there is -- We need to think about these burdens with respect to public health and safety and what is really necessary versus what is unnecessary.

That's where I think the question is, is this for managing plant assets or is it for public health and safety. I think that's the question that we are asking ourselves internally what is necessary, okay, and for the latter.

Next slide. Okay, so this we've got to give a shout out to the Staff, Theresa and to your folks, for some of the changes that were made between

December and January and January to today.

I saw these slides a few days ago, so this is -- So these slides were slides were prepared well before that, so please know that this -- I just give this caveat that the Staff's changes, thank you very much for the changes, we will look at them and see, you know, but I think that the path, the concern on this one was addressed in a lot of ways where it allows for alternate TBS approaches that, as you've mentioned, you were asking about, Alternative 5, Modified Alternative 5 as we see it, Modified Alternative 5 for the EPRI alternate licensing strategy.

Allowing those changes to allow us to use that, I can tell you there is a lot of PWRs out there who are very interested in using that approach, and so that was a very positive change.

I think that some of the inspection part of it, as you heard during the discussion here, some of it has a ways to go there, and decide, determine where those inspection requirements should be to maintain public health and safety.

So, let's see here, what else. I think you hit it. I don't know if we need to go over this slide much more because I think you -- So we can go to

the next slide.

So stipulated predictability. You know, this is where when you talk about analysis paralysis and this is where we are seeing that areas and some of the wording about leaving it up to Staff determination and not having it in a Reg Guide or having some predicable path in a Reg Guide is a concern to us because that leads to analysis paralysis.

We talked about Draft Guide 1428 last time with the multiple flow charts and multiple places where you make, the Staff makes their determinations, and each one of them can take, probably could take, you know, a lot of time for each one of those.

So these are the areas where when we are talking about stability and predictability it leads up to the implementability of the rule. So we heard about best estimate, so I don't want to talk about that. That was really in line with some of the areas we were looking at in terms of nominal values.

If we were to do any analysis post for a large-break LOCA if it's beyond size and it's let's say beyond design basis accident now, I think there was a question about whether we should be doing anything.

I think with Staff and what we have

learned with ATWS and other things where those are beyond design basis accidents, this was also another area where we compromised and said that this may be a path forward to meet the schedule that we were talking about, that if we were to use a true best estimate for beyond design basis large-break LOCA this may be a better place to meet in the interim with this rule package, but, again, that could be up for further workshops.

I think that's really -- I would love to -- Oh, the backfit and forward fit, we talked about that last time as well with respect to this voluntary rule. We are concerned with Like, for example, back -- We did get the change in the LOCA definition, see the second sub-bullet there, and for the forward fit and backfit that was a big concern.

We appreciate the Staff for returning the LOCA definition to historic norms, but, again, that concern over backfit and forward fit, looking into, for example, the breakaway oxidation testing and things Like along those lines, we really want to make sure that we are backfitted into other requirements for the legacy fleet that isn't going to be incorporating high enrichment or higher burn-up fuel.

Next slide. So it gets into the breakaway

oxidation. We do believe that the breakaway oxidation testing requirements should be removed. We don't think it should be in the rule.

With respect to it being a technology neutral, we do believe that when you put in into the rule the names or the cladding alloys that are approved it's not technology neutral anymore and you have to come in with exemptions if you want to do a new alloy cladding or if you have another alloy cladding you come up with.

So in this way we would rather not have to do exemptions in perpetuity whenever new alloys come in. Have those types of requirements in a reg guide or have those names in a reg guide where it can be easily addressed and not have to go through a rulemaking again every time we have to go and want to put in new alloys. So that's another one that we thought about.

We also believe that the concerns over the augment inspections, you know, this again I think we need to think of it in terms of a lot of those modernized, all the things that we did post-Davis-Besse and take a look in all the other inspections that we've done, all of the augmented inspections that we've done, all the ASME code requirements, okay.

We want to make sure that also these inspections are, you know, there is the Data Quality Act, there is these OMB circulars that require the NRC to use the consensus of Codes & Standards whenever practical, okay, and are prescriptive, deterministic.

Additional augmented inspections outside of the process is that reasonable? We're unsure about that and I think that's where, again, we need to think about it with risk in mind, risk to public health and safety and not to asset management.

And then the legacy reporting process, these are things that we believe that there is a lot of reporting requirements that were part of the older 2010 rule that we need to think about what makes sense and what just needs to be deleted because there are either duplicative, triplicative types of redundant reporting requirements.

So these are things that we can work out through workshops with the Staff. I think that -- I think we have one more slide. I think basically we would Like to see a more realistic, you know, we would Like to enable more realistic operational margins.

We are in a place now where we've had LOCAs on the books for over 50 years, okay, and since that time we have now created new sciences in fracture

mechanics, new sciences to the classic fracture mechanics, new sciences in in-service inspection, applied physics in terms of being able to inspect welds with ultrasonics and not just radiographs, okay.

We have had all this new work to be able to do component integrity calculations and we're still in the same spots as we were in a lot of cases in terms of some of the ways we evaluate LOCA and we're not looking at it also from sometimes in a risk-informed perspective.

Therefore, what we are saying is how do we enable the more realistic operational margins, ensure safety, we do not want to have any safety problems with power uprates or putting in new fuel, okay, but we have these new operational margins that we think we can leverage to get more benefit to the public.

I don't want to belabor all of this, we talked about it at the last meeting, if there is anything else you would Like to hear I can chime in and answer, but with that I'll just turn it over to you for a second time.

CHAIR KIRCHNER: Thank you, Al, for doing that so efficiently. So, Members?

MEMBER HARRINGTON: Just quickly, have you started with the Staff, this is kind of a dual

question for both of you, have you started the conversations about planning these workshops?

There is a lot of specific topics and my sense is much of this can be improved and worked out through those workshops but they need to be carefully thought out, carefully planned, scheduled, work done to prepare for them, it's not just Like show up on a Tuesday and let's have a conversation.

MR. CSONTOS: Oh, yes, right. And that's why I was down at the EPRI NTC meetings because we were looking at getting the technical information to be developed, getting the funding and everything associated with White Papers and all the other things that we want to bring to bear to provide as input to these workshops.

It's not just get together and chat. It's really building a technical basis for going forward with the safety argument, okay. And in this case we have to also be mindful of the rulemaking process, and I don't want to get the Staff in trouble here by breaking the process rules, okay.

The Staff has to send this up to the Commission with your approval, okay, and then the Staff, or the Commission, reviews it and then sends it back out for public comment, and that's when we can

officially start on many of these areas.

We would love to start right away, but what we are doing on our end is developing a lot of these White Papers and trying to get things in order to support those workshops that I hope will start, you know, as early as spring sometime on maybe other topics, but on topics that are specific to the rulemaking, correct me if I'm wrong, Theresa, and you can speak to it, we want to make sure we don't, we want to follow the rulemaking process.

MR. STAVELY: Jim Stavely, PSEG. What I would Like to add to that was I was the Industry sponsor for Reg Guide 1.183 and what really came out of that was the value of the plan, as you are indicating workshops, is you have to prep for them, you have to have agreement on the presentations, and it's a great interactive evolution that can move the regulations and the supporting reg guides further along, but it needs that prep to be able to do it.

As Al said, it's not a chat to see what's your opinion, what's my opinion, it's the idea of what can we do, what is viable in the schedule to get back to, as Al said, we really need that schedule to be maintained based on the plans and actually the activities in process by the various utilities to

proceed with this assuming the rule keeps to that schedule and it's implementable, but we need to make this work.

The workshops, as you described, there is still is opportunity for the Industry and the Staff to be able to improve this rulemaking and supporting guidance and the workshops are key to make that happen and to maintain schedule.

CHAIR KIRCHNER: We're going to let the Staff make a comment now.

MS. CLARK: Just one clarification that Joe will provide based on one of the slides.

CHAIR KIRCHNER: Yeah.

MR. MESSINA: Yes. It was stated that the rule that it should be technology neutral with respect to cladding alloys and exemptions would be required for cladding alloys.

This rule is technology neutral. You can use your radium nitride and silicon carbide even and not require an exemption. There's nothing that would require an exemption for different alloys for fuels.

MEMBER HARRINGTON: That's what I understood.

MR. MESSINA: Yes.

MEMBER HARRINGTON: Yeah.

MR. MESSINA: I wanted to make that clarification. Thank you.

CHAIR KIRCHNER: Thank you, Al, thank you, Jim, and thanks to the Staff for their presentations, too. At this point, Ron, let's see --

MEMBER BALLINGER: Are we bound to go for public comment?

CHAIR KIRCHNER: Yes, we should.

(Simultaneous speaking.)

CHAIR KIRCHNER: Public comment, yeah, that's where I was going. Thank you. Okay, for those listening in, those in the room, if you wish to make a comment please do so, just state your name, affiliation as appropriate, and make your comment.

Just unmute yourself and you can go ahead, Ed Lyman. Go ahead, Ed.

MR. LYMAN: Thank you. It's Ed Lyman from Union of Concerned Scientists. Can you hear me?

CHAIR KIRCHNER: Yes. Go ahead.

MR. LYMAN: Yes. So I probably should have prepared some remarks in advance, but I would just Like to express my view. Stepping back in what's going on here and, you know, NEI purports to speak to what's good for public health and safety and I don't believe that they are.

What we're talking about here is ensuring that fuels that are used in the U.S. reactor fleet are fully qualified and tested to ensure that they are consistent with the safety basis that the public expects them to be.

We know that that isn't the case today. We know that the fuels and claddings that are in reactors today are being radiated to burn-ups that are beyond what the existing rules -- Well, the existing rules do not account for those materials at the burn-ups that that they are currently allowed to use in reactors.

What we are talking about moving forward is instead of solving that problem, which the original 50.46© would have to some extent, they are talking about going to regimes pushing fuel well beyond the limits that are already not consistent with the current safety basis, talking about power uprates, increased burn-ups, longer fuel cycles with new materials, and then essentially saying that they don't have to be tested to qualify to those conditions, and that is just wrong.

I would just invite the Committee to step back and look at the history again and where we are and how the process that was originally the ATF

process, which was originally initiated as an attempt to increase safety margin after Fukushima, has been perverted into pushing fuels, pushing reactors into spaces where safety margin is going to be degraded, totally in opposition to the original goal of that program, and that is just wrong.

So I just wanted to provide that greater context here because I am very concerned about the direction things are going in, especially if the rules are changed to reduce or eliminate the need to actually demonstrate the safety of these new fuels and materials at these extended operating regimes. Thank you.

CHAIR KIRCHNER: Okay. Further comments from the public?

(No audible response.)

CHAIR KIRCHNER: I'm not hearing any. Then at this point I think we are going to recess and return at 1:15 Eastern Time. So we are in recess. Thank you, everyone.

(Whereupon, the above-entitled matter went off the record at 12:20 p.m.)

IE Rulemaking: Industry Feedback

Al Csontos – NEI
Director, Fuels

January 16, 2025

NUCLEAR ENERGY INSTITUTE

IE Rulemaking Key Messages

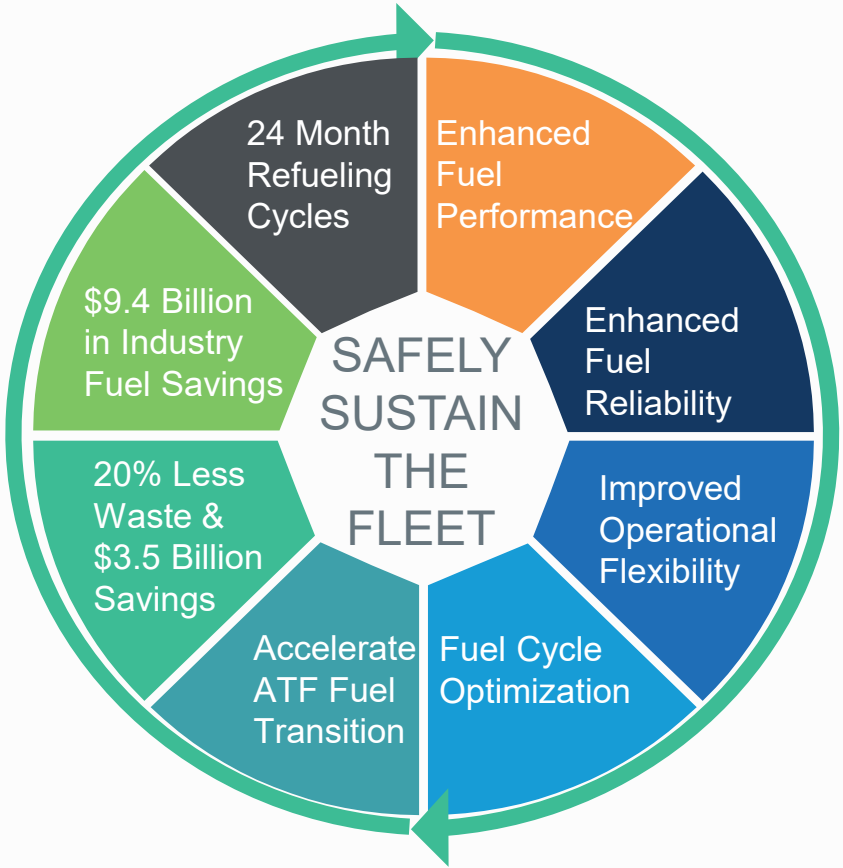
- LARs for uprates and/or advanced fuels are on the way
- IE rule and schedule are vital to industry strategic plans
- Draft IE Rule from the recent ACRS meetings has many appropriate improvements, but major concerns remain
- Industry feedback remains consistent with recent NEI letters:
  - March 2023 (ML23107A230)
  - January 2024 (ML24023A604)
- ACRS should allow the draft IE rule for Commission review
- Workshops needed for industry engagement on concerns

ADVANCE Act alignment for a modern, risk-informed, and efficient IE Rule

IE Rulemaking Key Messages

- Generally, beneficial impacts with the overall rule package:
  - 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 inefficiencies resulting in high uncertainty to implementation

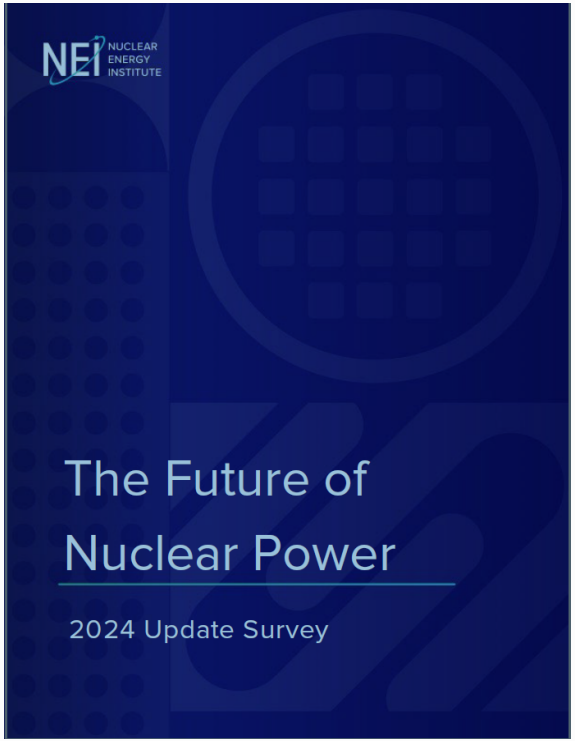
Enabling Advanced Fuel Technologies



- ATF/LEU+/HBU fuels are complementary to uprates and enabling in some cases
- Modern advanced fuel technologies can:
  - Enable 24-month fuel cycles for PWRs
  - Less waste = improved safety/fuel efficiency
  - Improve plant resiliency and performance
  - Increase potential for power uprates
  - 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



Prioritized Concern: Implementation

- 2010 50.46a rule: substantial implementation burden compared to the potential benefits obtained (ML100260383 & ML10316027)
- Does not reflect improvements, efficiencies, and learnings gained from fleet-wide risk informed change programs since 2010:
  - RIEP duplicates requirements for implementing risk informed change programs already communicated in RG-1.200 and RG-1.174
  - DG-1428 still requires plant specific seismic analyses even though the industry addressed seismic risk per NRC 50.54 order after Fukushima
- More stringent criteria with additional unnecessary burdens than currently required, e.g. change control, inspections, reporting, etc.

Prioritized Concern: Flexibility & Durability

- Codifying a prescriptive TBS definition with additional inspection requirements hardwires a single solution pathway:
  - May not be applicable or readily implementable for many LWR sites
  - May lead to future rulemaking and/or numerous exemption requests
  - Assumes that BDBA LOCA treatment is sufficient to address FFRD
- Rule should allow alternative approaches for defining and implementing TBS with prescriptive requirements moved to RGs
- Minimal changes in rule language provide more flexibility and durability capable of supporting future regulatory improvements without need for exemption requests, e.g. EPRI ALS, Alt. #4, etc.

Prioritized Concern: Stability & Predictability

- Straightforward implementation of the rule needs regulatory clarity, stability, and predictability to well-defined NRC acceptance criteria:
  - Technical areas open to interpretation can lead to analysis paralysis
  - Industry appreciates staff returning LOCA definition to historical norms
- What is meant by best estimate LOCA for breaks above TBS?
  - NRC expectations for “true best estimate” are not clear or predictable
  - BDBA analyses should not be obscured by artificial biasing
- Need a clear and predictable path forward for addressing dispersal
- Forward fit and backfit guidance needed for this voluntary rule regarding future licensing actions not involving LEU+/HBU

Prioritized Concern: Modernization

- Breakaway oxidation testing requirements should be removed:
  - NEI March 2023 letter (ML23107A230)
- Rules should be technology neutral wrt approved cladding alloys:
  - Exemptions would be required for several existing approved alloys
- Prescriptive augmented inspections result in unnecessary additional occupational dose to plant staff and is not risk-informed
- Legacy reporting requirements should be updated and/or removed, especially for BDBA LOCA considerations

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

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Proposed Rule: Increased Enrichment of Conventional and Accident Tolerant Fuel Designs for Light-Water Reactors

February 5, 2025

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Opening Remarks

Theresa Clark
Director
Division of Safety Systems

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Overview of Increased Enrichment Rulemaking

Philip Benavides
Project Manager
Reactor Rulemaking & Project Management Branch

Issue Identification

- **Regulatory Issue:**
  - Current licensing framework allows for the use of ≤ 5.0 weight percent uranium-235; however, technology developments may require numerous exemptions to utilize fuel enriched above 5.0 weight percent.
- **Proposed Solution:**
  - Rulemaking would provide for a generically applicable standard informed by public input, providing consistent and transparent communication, rather than individual licensing requests as discussed in SECY-21-0109, "Rulemaking Plan on Use of Increased Enrichment of Conventional and Accident Tolerant Fuel Designs for Light-Water Reactors."
- **Commission Rulemaking Plan Approval:**
  - Staff request to pursue rulemaking and develop a regulatory basis was approved by the Commission via SRM-SECY-21-0109.

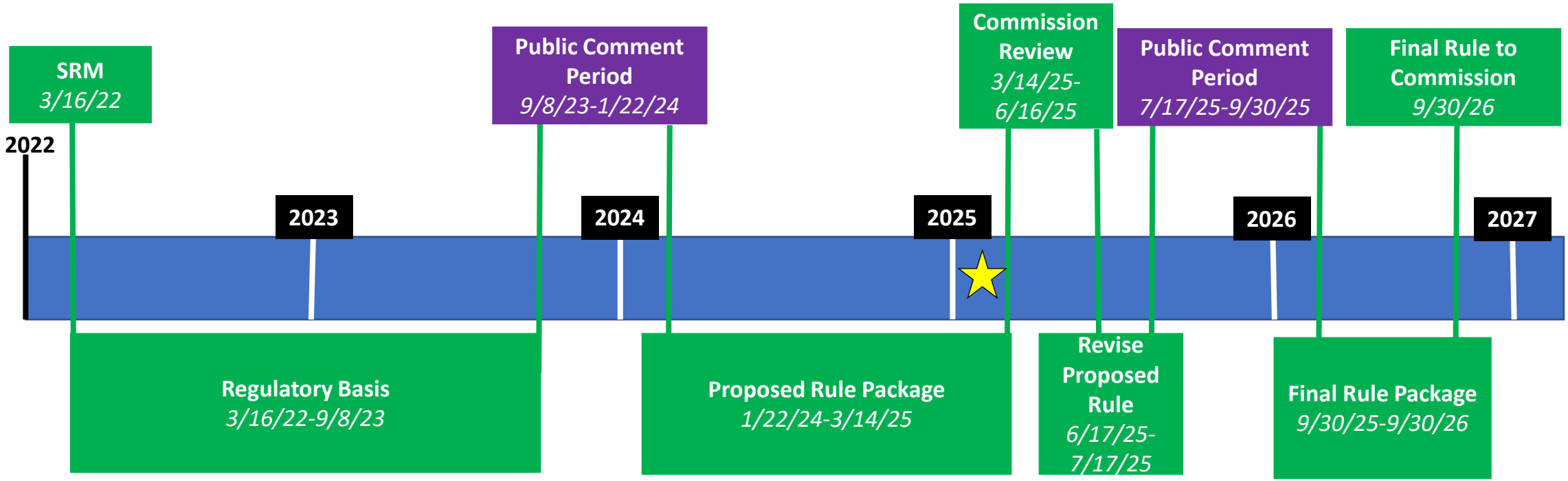
SRM-SECY-21-0109 Overview

- SRM-SECY-21-0109 was issued on 3/16/22, in response to SECY-21-0109.
  - The Commission approved the staff's proposal to initiate a rulemaking to amend requirements for the use of light-water reactor fuel containing uranium enriched to greater than 5.0 weight percent uranium-235.
  - Provisions to the rule should only apply to High-Assay Low-Enriched Uranium (HALEU).
  - Fuel Fragmentation, Relocation, and Dispersal (FFRD) should be appropriately addressed.
  - Staff directed by the Commission to take a risk-informed approach.

Status of Rulemaking Activity

- **The NRC staff issued a regulatory basis on September 8, 2023 (ADAMS Accession No. ML23032A504)**
- **Stakeholder Involvement:**
  - Before Regulatory Basis Issued:
    - Public Meeting on June 22, 2022 (ML22208A001)
  - After Regulatory Basis Issued:
    - Public Meeting on October 25, 2023 (ML23319A259)
    - Comment Period closed on January 22, 2024
    - Publicly shared Fuel Dispersal insights at the NRC's Annual Higher Burnup Workshop on September 3, 2024 (ML24277A161)
- **The Increased Enrichment proposed rule package is in concurrence.**
  - Proposed rule due to the Commission: March 2025

Status of Rulemaking Activity



Note: Dates listed are estimates only, and thus are subject to change.

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

NRC Staff Presenters

- **Charley Peabody, NRR:**
  - Criticality Accident Requirements (10 CFR 50.68)
- **Jason Piotter, NMSS:**
  - General Requirements for Fissile Material Packages (10 CFR 71.55)
- **Elijah Dickson, NRR:**
  - Control Room Requirements (10 CFR 50.67 and GDC-19)
- **Joseph Messina, NRR:**
  - Fuel Fragmentation, Relocation, and Dispersal (10 CFR 50.46a)

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Criticality Accident Requirements of 10 CFR 50.68

Charley Peabody
Nuclear Systems Performance Branch
NRR

Criticality Accident Requirements of 10 CFR 50.68

- This rulemaking would amend the current 5.0 weight percent U-235 limit in 50.68(b)(7) and allow for an alternative between the existing 5.0 weight percent U-235, or a plant-specific criticality safety limit based on the limit specified in a licensee's or applicant's operating license.

- Licensees would be allowed to increase enriched fuels above 5.0 weight percent as long as this increased enrichment level is approved specifically in their technical specifications design features or equivalent part of the operating license as a part of a fuel transition license amendment request.

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Questions?

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Packaging Requirements of 10 CFR 71.55

Jason Piotter
New Fuels Team
NMSS

Packaging Requirements of 10 CFR 71.55

- Current transportation regulations are adequate to certify UF6 transportation packages with material enriched up to 20.0 weight percent U-235. (10 CFR 71.55(b), 71.55(c), 71.55(g)).

- 10 CFR 71.55(g), specific to UF6 transportation packages, is an exception to 71.55(b), which requires the consideration of moderator when performing criticality calculations. For UF6 packages with enrichment levels up to 5.0 weight percent U-235 certified under 71.55(g), moderator does not have to be considered in criticality calculations.

Packaging Requirements of 10 CFR 71.55

- This rulemaking would amend 10 CFR 71.55(g) to allow the current exception of UF6 enriched up to 5.0 weight percent U-235 to expand to 10.0 weight percent U-235. This amended rule would require a defense-in-depth design feature for those packages containing UF6 enriched between 5.0 and 10.0 weight percent U-235.

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Questions?

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Control Room Design Criterion of 10 CFR 50.67 and GDC-19

Elijah Dickson
Radiation Protection and Consequence Branch
NRR

Control Room Design Criterion of 10 CFR 50.67 and GDC-19: Summary of Regulatory Issue

- This rulemaking would amend the control room design criteria from the current 5 rem (0.05 Sv) total effective dose equivalent (TEDE) to a revised value of 10 rem (0.10 Sv) TEDE; the value may range up to 25 rem (0.25 Sv) TEDE with consideration of the plant-specific risk profile or risk information.

- The amended rule, and subsequent guidance, would align with Commission direction provided in SRM-SECY-98-144 to take a risk-informed, performance-based approach to regulations and guidance.

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Questions?

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Fuel Fragmentation, Relocation, and Dispersal

Joseph Messina
Nuclear Methods and Fuel Analysis
NRR

Fuel Fragmentation, Relocation, and Dispersal

- This rulemaking would enable entities to voluntarily recategorize large-break loss-of-coolant accidents (LOCA) as beyond design basis accidents, leveraging the previous 50.46a rulemaking, which was delivered to the Commission as a draft final rule in 2010, but rescinded due to Fukushima and a lack of industry interest.
- This rulemaking would divide the current spectrum of LOCA into two regions delineated by a transition break size (TBS). The smaller region (breaks up to the TBS) would be treated same as all breaks under the current 10 CFR 50.46 emergency core cooling system (ECCS) rules. The larger region (breaks greater than TBS) would be allowed to be analyzed using best-estimate modeling and more realistic assumptions based on their lower likelihood of occurrence.

Fuel Dispersal

- While the wording is not significantly different regarding coolability than 50.46, the NRC staff added a discussion in the Federal Register Notice (FRN) Preamble (formerly known as Statements of Consideration) that adds clarification on the interpretation of coolability:
  - The NRC can envision that some amount of dispersed fuel can remain coolable and safe during a LOCA, therefore the NRC finds that if it can be shown to be safe, then it may be acceptable.
- True best-estimate modeling and realistic assumptions are expected to significantly reduce or eliminate the calculated potential for fuel dispersal
  - DG-1434 provides guidance on fuel dispersal
- While this approach does not explicitly address non-mechanistic approaches to evaluating FFRD, as described in other alternatives in the IE Regulatory Basis, other licensing pathways exist
  - E.g., the topical report review process
  - The performance-based criteria are expected to facilitate option of these alternatives (including a less prescriptive interpretation of core coolability)

Changes Made Since January ACRS Subcommittee Meeting

Weld inspections:

50.46a(b)(3) requirement to inspect 10% of similar metal welds on piping larger than the TBS has been replaced with "an NRC-approved sampling of similar metal welds."

Allowing operating reactors to define their own TBS:

Transition break size (TBS) for reactors licensed under this part before December 31, 2015, is a break area equal to the largest cross-sectional flow area of the reactor coolant pressure boundary piping excluding the hot leg, cold leg, or crossover leg piping for a pressurized water reactor, or the largest cross-sectional flow area of either the feedwater line or residual heat removal line inside containment for a boiling water reactor, **or a plant-specific alternative break area**. For reactors that are or will be licensed under this part after December 31, 2015, and for light-water reactors (LWRs) that are or will be licensed under part 52 of this chapter, the TBS will be determined on a plant-specific basis.

Clarification on alternative approaches:

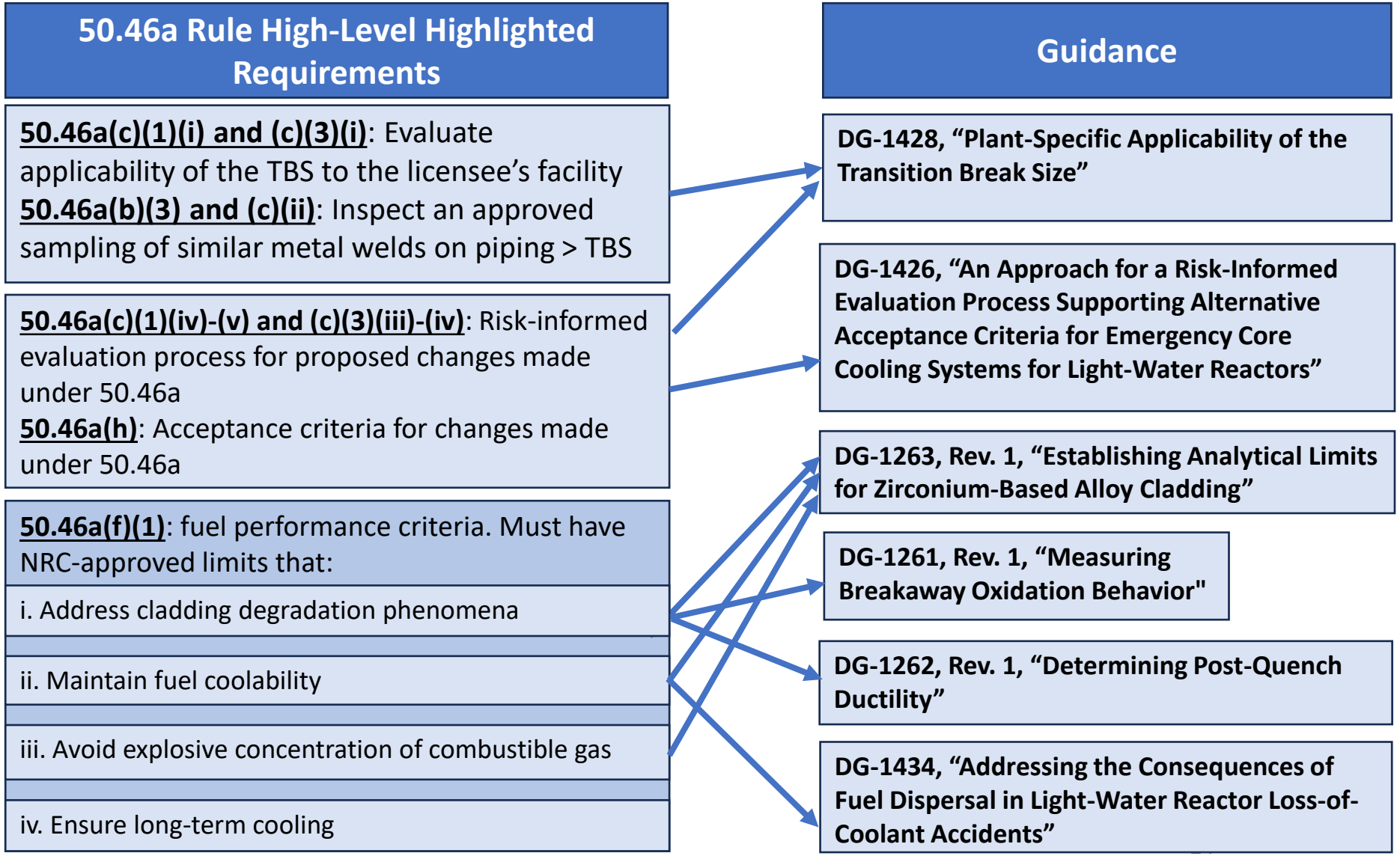
Added clarification in the Preamble and SECY paper that the performance-based view of coolability in 50.46a(f) and the fact that fuel dispersal is not necessarily incompatible with coolability can facilitate alternative approaches to addressing FFRD. The staff plans to continue engaging with industry on other approaches (e.g. modified Alternatives 4 and 5) via licensing interactions and workshops.

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Proposed 50.46a Highlighted Requirements

The primary requirements of 50.46a are:

- Weld inspections for similar metal welds on piping > the TBS
- Evaluation of plant-specific applicability of the TBS
- Evaluation that changes made do not invalidate the TBS
- A risk-informed evaluation process is established to analyze changes enabled by 50.46a
  - Changes must be kept to very small risk increases (i.e., ΔCDF ≤ 1E-6/rx.yr. and ΔLERF ≤ 1E-7/rx.yr.) and the overall risk must remain small
- Principal ECCS criteria
  - Maintain fuel coolability
  - Long-term cooling
- Fuel performance criteria:
  - Address cladding degradation phenomena
  - Maintain fuel coolability
  - Avoid explosive concentration of combustible gas
  - Long-term cooling
- Breaks at or below the TBS must continue to have a ***high probability*** that the ECCS and fuel performance criteria are met
- Breaks above the TBS must demonstrate that ECCS and fuel performance criteria are met to at least a ***best-estimate*** level


50.46a Rule High-Level Highlighted Requirements
50.46a(c)(1)(i) and (c)(3)(i): Evaluate applicability of the TBS to the licensee's facility
50.46a(b)(3) and (c)(ii): Inspect an approved sampling of similar metal welds on piping > TBS
50.46a(c)(1)(iv)-(v) and (c)(3)(iii)-(iv): Risk-informed evaluation process for proposed changes made under 50.46a
50.46a(h): Acceptance criteria for changes made under 50.46a
50.46a(f)(1): fuel performance criteria. Must have NRC-approved limits that:
i. Address cladding degradation phenomena
ii. Maintain fuel coolability
iii. Avoid explosive concentration of combustible gas
iv. Ensure long-term cooling
Guidance
DG-1428, "Plant-Specific Applicability of the Transition Break Size"
DG-1426, "An Approach for a Risk-Informed Evaluation Process Supporting Alternative Acceptance Criteria for Emergency Core Cooling Systems for Light-Water Reactors"
DG-1263, Rev. 1, "Establishing Analytical Limits for Zirconium-Based Alloy Cladding"
DG-1261, Rev. 1, "Measuring Breakaway Oxidation Behavior"
DG-1262, Rev. 1, "Determining Post-Quench Ductility"
DG-1434, "Addressing the Consequences of Fuel Dispersal in Light-Water Reactor Loss-of-Coolant Accidents"

TBS development

Historic TBS Technical Basis:

- Passive System LOCA frequencies developed for generic BWR and PWR plants through an expert elicitation process (NUREG-1829)
  - Accounted for panelist uncertainty and variability among responses
  - Used results as the starting point for selecting the transition break size
- Increased TBS to address additional factors and to promote regulatory stability
  - Considered other types of LOCAs
  - Accounted for plant piping design and operating experience
- Performed confirmatory study to determine if risk of LOCAs > TBS due to rare seismic was acceptable (NUREG-1903)
  - Risk due to unflawed and flawed direct piping failures expected to be acceptable for most, if not all, plants
  - Risk due to indirect piping failures acceptable for two cases evaluated
  - Seismic risks, however, are plant-specific, making it difficult to generalize results

Recent Confirmation of the TBS Technical Basis:

NUREG-1829 Confirmation:

- Internal and External Elicitation
- Impact of Recent Operational Experience

} Qualitative

- Probabilistic Fracture Mechanics Study
- International Operational Database Study

} Quantitative

NUREG-1903 Confirmation:

- Evaluated three cases: unflawed and flawed piping failure and indirect piping failure by other components and component supports.
- Used most recently updated seismic hazard curves for the assessment
- For unflawed piping, failure probabilities were significantly low compared to the 1E-05 per year frequency used as a basis to establish the TBS.
- Flawed piping and indirect failure frequencies expected to be < 1E-05 per year but more comprehensive, plant-specific analysis needed to confirm.

TBS Confirmation:

- LOCA frequencies and TBS are applicable if plant specific applicability is demonstrated.
- New designs can develop plant specific TBS.
- Inspection of the piping welds with diameters greater than the TBS are needed to ensure LOCA frequencies remain applicable.

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Cladding Testing: DG-1261 through 1263

DG-1261, Rev. 1: Measuring Breakaway Oxidation Behavior

- NRC's LOCA program showed that minor changes in alloy composition or manufacturing processes can have significant impact on breakaway oxidation behavior
- Defines an experimental technique capable of determining the effect of composition changes or manufacturing changes on the breakaway oxidation behavior
- Discusses both initial testing and periodic confirmatory testing

DG-1262, Rev. 1: Determining Post-Quench Ductility

- Defines an experimental technique to measure the ductile-to-brittle transition for the zirconium-alloy cladding material
- Provides detailed discussion of determining the ductile-to-brittle transition CP-ECR for a given hydrogen level; allows for binning results with similar H content

DG-1263, Rev. 1: Establishing Analytical Limits for Zirconium-Based Alloy Cladding

- Describes an approach to establish limits to address zirconium-alloy cladding degradation phenomena
  - Analytical limits for post-quench ductility and breakaway oxidation
  - PCT limit to address post-quench ductility also protects against higher-temperature degradation mechanisms
- Provides guidance on how to consider the impact of oxygen diffusion from inside surfaces on cladding degradation
- Provides default cladding hydrogen uptake models for currently approved cladding models
- Provides an analytical limit for combustible gas generation.

“True Best-Estimate”

- LOCAs above the TBS must be analyzed to at least a “true best-estimate” level.
- Consistent with what is permitted in other beyond DBAs, such as ATWS and SBO.
- The NRC staff specified in the Preamble of the proposed rule FRN that “true best estimate” analyses are based on nominal inputs, without conservative biases, and without adding uncertainties.
- The NRC staff plans to align with industry on a definition in workshops in the final rule phase.

Questions?

Backup Slides

Associated Guidance

- **Control Room Design Requirements (10 CFR 50.67 and GDC-19)**
  - DG-1425, “Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors”
- **Fuel Fragmentation, Relocation, and Dispersal**
  - DG-1261, Revision 1, “Measuring Breakaway Oxidation Behavior”
  - DG-1262, Revision 1, “Determining Post-Quench Ductility”
  - DG-1263, Revision 1, “Establishing Analytical Limits for Zirconium-Based Alloy Cladding”
  - DG-1426, “An Approach for a Risk-Informed Evaluation Process Supporting Alternative Acceptance Criteria for Emergency Core Cooling Systems for Light-Water Reactors”
  - DG-1428, “Plant-Specific Applicability of the Transition Break Size”
  - DG-1434, “Addressing the Consequences of Fuel Dispersal in Light-Water Reactor Loss-of-Coolant Accidents”