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NUCLEAR REGULATORY COMMISSION

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617TH MEETING

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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THURSDAY

SEPTEMBER 4, 2014

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ROCKVILLE, MARYLAND

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

COMMITTEE MEMBERS:

JOHN W. STETKAR, Chairman

HAROLD B. RAY, Vice Chairman

DENNIS C. BLEY, Member-at-Large

SANJOY BANERJEE, Member

CHARLES H. BROWN, JR. Member

MICHAEL L. CORRADINI, Member

JOY REMPE, Member

PETER RICCARDELLA, Member

MICHAEL T. RYAN, Member

STEPHEN P. SCHULTZ, Member

DESIGNATED FEDERAL OFFICIALS:

MIKE SNODDERLY

CHRIS BROWN

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P R O C E E D I N G S

8:31 a.m.

CHAIRMAN STETKAR: The meeting will now come to order. This is the first day of the 617th meeting of the Advisory Committee on Reactor Safeguards.

During today's meeting, the Committee will consider the following: SECY-14 unnumbered as yet, Qualitative Considerations of Factors in the Development of Regulatory Analyses and Backfit Analyses; Draft Final Generic Letter 20 unnumbered yet, Monitoring of Neutron Absorber Materials in Spent Fuel Pools; Safety Evaluation Report associated with the Fermi Unit 3, Combined License Application referencing the Economic Simplified Boiling Water Reactor Design; and preparation of ACRS reports.

This meeting is being conducted in accordance with the provisions of the Federal Advisory Committee Act.

Mr. Michael Snodderly is the designated federal official for the initial portion of the meeting.

Portions of this session on the Fermi Unit 3 COLA may be closed in order to discuss and protect information designated as proprietary.

We have received written comments and a request to make oral statements from Mr. David Schonberger, a member of the public, regarding today's sessions for the Fermi combined license application and we'll make some time for him during that session.

There will be a phone bridge line. To preclude interruption of the meeting, the phone will be placed in a listen-in mode during presentations and Committee discussion.

A transcript of portions of the meeting is being kept and it is requested that speakers use one of the microphones, identify themselves and speak with sufficient clarity and volume so that they can be readily heard.

And I'd like to remind everyone to turn off whatever little gadgets you have that tend to beep and make little noises during the meeting.

And with that, unless there's anything else from the members of the Committee, we'll proceed to the first item on our agenda, which is qualitative considerations of factors in the development of regulatory analyses and backfit analyses. And Harold Ray will lead us through that session.

Harold.

VICE CHAIRMAN RAY: Thank you, Mr.

Chairman. I am Harold Ray, Chairman of the Regulatory Policies and Practices Subcommittee.

Today we have members of the NRC staff to discuss what is now recently a numbered SECY, SECY-14-0087, which provides the Commission with the staff's recommendation for qualitative reconsidering factors in regulatory and backfit analyses.

The SECY was developed in response to Commission direction in an SRM dated March 13th, 2013. Although the SRM also dealt with the requirements of certain BWR containment venting systems, the staff's recommendations for qualitatively considering factors in regulatory and backfit analyses was directed to be generic and independent of containment venting.

The Regulatory Policies and Practices Subcommittee did hold a meeting on August 19th on the subject. So, today the full committee will receive a summary of the discussion we had at that time.

I now call on Aby Mohseni, Deputy Director of the Division of Policy and Rulemaking, NRR, to introduce the presentation and begin.

MR. MOHSENI: Thank you very much, Dr. Ray. Good morning. I am Aby Mohseni, the Deputy Division Director of the Division of Policy and Rulemaking in NRR.

Thank you for the opportunity to brief you today on the notation vote SECY paper, "Qualitative Considerations of Factors in the Development of Regulatory Analyses and Backfit Analyses."

In regulatory analysis and backfit analysis to informed decision-makers, we consider many factors both quantitatively and qualitative consistent with Commission direction, NRC guidance, OMB Circular A-4, executive orders and international practices.

Specifically when needed, qualitative considerations of factors is used in conjunction with quantitative considerations in risk-informed decisions, adequate protection determinations and cost-justified substantial safety enhancements.

While the regulatory frame is sound, we recognize that specific guidance is needed on how qualitative considerations are conducted.

In a few moments, Fred Schofer, our resident expert practitioner and team leader, will provide a presentation on this paper and discuss the status and background, but just some initial points I'd like to note as was mentioned by Dr. Ray.

The staff submitted this paper SECY-14-0087 to SECY on August 14. The SECY paper was made publicly available on September 2nd.

This paper was in response to the SRM on filtering strategies, SRM SECY-12-0157, which said independent of the BRW Mark I and Mark II containment filtration issue, staff should seek detailed Commission guidance regarding the use of qualitative factors in a future notation voting paper.

Though this paper came from the direction on filtering strategies, it falls under the auspices of the agency-wide Cost-Benefit Working group. And some of those working group members are here in the audience today.

This paper and implementing the Commission direction on this topic are part of the NRC's overall plan for updating cost-benefit guidance.

I'll note that on June 11, the staff provided a full committee ACRS briefing on this plan to update cost-benefit guidance, which is found in SECY-14-0002.

Thank you again for the opportunity to brief you on this notation vote SECY paper. We look forward to hearing from you in this discussion.

Thank you, and Fred.

MR. SCHOFER: Thank you, Aby. My name is Fred Schofer and I'm in the rulemaking branch in the Office of NRR. And I thank you for the opportunity to brief you on this SECY paper today titled, "Qualitative Consideration of Factors in the Development of Regulatory Analyses and Backfit Analyses."

I wanted to let you know that although the paper was made available September 2nd, publicly available, there was a glitch. The main paper itself was only replicated and made available this morning. So, both the paper and the slides for today's meetings are publicly available. The paper is at ML14127A458. The slides are ML14245A043.

The purpose of today's briefing is to go over that notation vote SECY paper and its enclosures. The outline that is shown for today's presentation will begin with an overview and a status, and then walk through the package itself concluding with the staff's proposal.

The stuff submitted the paper, as Aby indicated, about three weeks ago. And this is a notation vote SECY paper that the staff is seeking Commission approval of the staff's proposal on how to better implement our practices with regard to qualitatively considering factors.

As noted in Aby's introductory remarks, we look forward to hearing your views on this paper in a subsequent letter.

This slide, the overview and status slide, provides a bit of context of the paper. The staff requirement memorandum, SRM SECY-12-0157, regarding the consideration of additional requirements of containment venting systems for boiling water reactors with Mark I and Mark II containments, directed the staff independent of the containment filtering strategies issued, to seek detailed Commission guidance regarding the use of qualitative factors in a future notation vote paper.

As a brief reminder, the context behind that, the qualitative analysis and the regulatory analysis for this SECY paper that was for the containment vent, did not provide sufficient cost justification for installing engineered filters.

In that analysis, the staff based its recommendation on a quantitative analysis supplemented by qualitative arguments to justify the staff's recommendation.

Based on the Commission direction and the context of the original SECY paper, the scope of this paper is to provide the staff's recommendation for the use of qualitative factors in regulatory analyses and backfit analyses.

MEMBER CORRADINI: So –

MR. SCHOFER: Yes.

MEMBER CORRADINI: I'll wait. I'm sorry.

MR. SCHOFER: Not a problem.

Okay. The work is part of the plan for updating the NRC cost-benefit guidance found in SECY-14-0002, as Aby briefly described.

The plan was submitted to the Commission in January and was discussed with the ACRS in June and this paper is one piece of that overall project.

Other pieces include SECY-13-0132, the Near-Term Task Force Recommendation 1, as well as the Risk Management Regulatory Framework Initiative.

The tie between those two are with the defense-in-depth discussion as a key component of both of those activities. We'll talk more about that in future slides, but the point here is defense-in-depth is one factor that has been considered qualitatively in past regulatory analyses.

A public meeting was held on Qualitative Consideration of Factors in May of this year. We of course were still in the process of developing the paper at that point.

We have already done quite a bit of the background research and were able to communicate the framework and how we qualitatively consider factors to members of the public.

During that meeting, the staff received a lot of positive feedback from members of the public, especially in enhancing our guidance on this topic.

That really was received positively among members of the public. They understood why we considered factors qualitatively and think that updating guidance was a good next step.

MEMBER CORRADINI: So, maybe this is the time to ask my question. So, meaning -- the interpretation I guess I was taking from that is that you do have a method now. The method is vague. They want less vague in terms of how you address the qualitative factors.

Because I remember in the discussion for venting strategies, the discussion at that time, I had a hard time understanding how they were applied.

MR. SCHOFER: What? Qualitative consideration?

MEMBER CORRADINI: Yes.

MR. SCHOFER: The current regulatory guidance documents, NUREG-BR-0058 and the handbook, do provide guidance with regard to consideration of qualitative factors.

The guidance is that the analyst should quantify as much as possible. But if there are other important aspects that aren't able to be quantified, that for completeness you should identify those and provide qualitative arguments for those.

MEMBER CORRADINI: Or against or however –

MR. SCHOFER: Or against, yes, providing, you know.

MEMBER CORRADINI: I understand.

MR. SCHOFER: Yes.

MEMBER CORRADINI: Okay.

MR. SCHOFER: So, the guidance is there. And it also indicates that there are various tools that could be applied such as, you know, break-even cost-effectiveness analysis to provide insights into the importance of those.

It also provides direction that when you're evaluating the results, that you first consider only the quantitative elements that is that which is calculated.

MEMBER CORRADINI: I remember that's how you presented it for the –

MR. SCHOFER: And that's in the guidance and it tells you to do a net cost-benefit and make a determination on that first.

After you present that, then you do a holistic analysis that includes both the quantitative and qualitative. And do that as a, you know, a discussion to guide you in developing the decision rationale and the recommendation.

MEMBER CORRADINI: Okay. So, you're going to probably get to this. So, the feeling was what was missing from – that sounds fairly complete at this point. So, what was missing? More guidance, or just more specificity as to the tools, the qualitative tools that you could use?

This is an area where I am not –

MR. SCHOFER: And this is something that we’re going to get into –

MEMBER CORRADINI: Okay.

MR. SCHOFER: -- in more slides, but I'll kind of give you a tidbit and then you can look for it.

MEMBER CORRADINI: Thank you.

MR. SCHOFER: Some of the guidance that we're talking about is, you know, how and when qualitative consideration should be used, you know. How much effort should be used to quantify versus not and, you know, should you have a plan in place and that type of thing.

So, as we get more into the slides, probably about nine or ten –

MEMBER CORRADINI: Okay.

MR. SCHOFER: -- we'll get to that point.

VICE CHAIRMAN RAY: Mike, let me suggest there's some phrases to look for. I assume Fred will use these, but they're certainly used in the paper.

Set of methods, there isn't a set of methods right now.   It's more ad hoc what he described.   And the goal is to be systematic, transparent and consistent.

Those are the key elements that are in this paper as ins of the effort.

MEMBER CORRADINI: Thank you.

CHAIRMAN STETKAR: Also, Fred, since you told us what to look for, the – one thing that we did discuss quite a bit and you just mentioned, and I'm hoping you'll get to it in your slides here, is that little phrase you use that said when you ought to apply the qualitative methods, under what conditions.

In other words, how far do you go in the quantification specifically within context of using qualitative considerations as a – I don't want to use the term "surrogate," but to enhance the understanding of areas of uncertainty.

In other words, how far do you quantify uncertainty? When do you start relying on qualitative?

So, if you could address that, because we did discuss that at some extent in the subcommittee meeting.

MR. SCHOFER: Sure.

MEMBER CORRADINI: Can I say it differently? You're saying that you don't want to sacrifice trying to quantify uncertainty –

CHAIRMAN STETKAR: Well, that's what I'm saying.

MEMBER CORRADINI: Okay. That's what I thought you said.

CHAIRMAN STETKAR: I'd like to hear the staff's kind of feedback on it, because that's a big issue.

In the past, they've often said, well, because the uncertainties are so large or because we don't have the ability to reasonably quantify the uncertainties because of lack of information or lack of tools or, you know, lack of something, we need to then rely on more qualitative considerations to bolster a decision or to provide other insights for the decision.

So, and I think that's a big part of this process in terms of not only what tools do you use to support the qualitative decision-making, but also when, you know, when you basically say I can't – I can't use simply quantitative methods to support the decision, as I said, especially in the area of trying to quantify uncertainties.

VICE CHAIRMAN RAY: With this interruption, let me add to John's comments. It triggered something in my mind that we didn't discuss at the subcommittee meeting, but which I find is quite important in the overall paper. And that is, what is the scope of this?

It is not just reactor regulation by any means. There's an enclosure that lists all the areas where qualitative considerations apply and many of them, most of them, almost all of them aren't the kind of things that we typically think of that have to do with when do I stop quantifying and start qualifying.

They're in areas of the Agency's business that have much different answers on that topic than, say, power reactor safety regulation.

And so, we've got to keep in mind here that we're not just talking about defense-in-depth applied to a power reactor, but everything the Agency does.

CHAIRMAN STETKAR: That's really important, because this was introduced in the context of the, you know, one specific regulatory analysis –

VICE CHAIRMAN RAY: Right.

CHAIRMAN STETKAR: -- that kind of prompted, you know, what we're discussing today. But, yeah, you're right, Harold.

In the SECY, the list of –

VICE CHAIRMAN RAY: Areas.

CHAIRMAN STETKAR: -- analyses that have in the past, those are really educating. If nobody has read that, it's really interesting to look at the types of analyses that have been done and start to think of it in the context of us, you know, thinking quantitative risk assessment, for example, for nuclear power reactors. The vast – actually, the majority of things you can't really reasonably use those methods.

VICE CHAIRMAN RAY: Yes. So, if we're going to focus on power reactors because we somehow think that's the most important thing, we need to separate it from what is the existing scope of the SECY –

CHAIRMAN STETKAR: Yes.

VICE CHAIRMAN RAY: -- which is everything the Agency does, basically.

CHAIRMAN STETKAR: Right.

MR. SCHOFER: Thank you.

MEMBER SCHULTZ: Fred, I didn't see it in your slides and I do want to see it discussed today. John talked about the plan, when does one do this and the how and what and why process as well.

But the other feature, and you touched on it, but when one does a cost-benefit value impact evaluation, you look at things that are in favor, will weigh in favor, there are costs in their benefits and you look at those in a quantitative evaluation.

It seems that when one looks at qualitative factors, one is prone to look at, oh, here are some other favorable things that would cause us to decide in favor of the decision. But a fair qualitative evaluation needs to introduce positive qualitative features, as well as the negative qualitative features and do a completeness evaluation of that as well especially if the quantitative evaluation can't be done.

And one understands that that is done, but sometimes one can be encouraged to say, well, my quantitative evaluation shows me this, but there's a number of other reasons I'd like to move forward. And so, here are all the positives that would benefit the decision, but one needs to look at the negative features associated with the qualitative evaluation as well.

MR. SCHOFER: And thank you for bringing that up. Absolutely our guidance is clear that we look at both the costs and benefits quantitatively and qualitatively. So, that point is not lost.

However, I think for this particular paper, we biased it more toward the positive simply because that was the crux of the issue.

I mean, we've been using these techniques since the original version of the guidance which is on this slide, the SECY-77-388A.

77 means that it was published in 1977. So, I mean, we have a pretty long history in using these techniques and it hasn't been that controversial.

CHAIRMAN STETKAR: Well, but, I mean, that being said, I think that Steve's, you know, we're not in the process of discussing any proposed method. That will come out of whatever the Commission decision on the SECY is.

One would hope that those methods if the Commission decides to go forward in this effort, would place emphasis on that type of balanced pros and cons that Steve is emphasizing because it is important.

As you said, in the particular instance that prompted, you know, our meeting today and this discussion, the qualitative considerations were more biased toward the, you know, the pros of that particular issue.

But one would hope that if the Agency adopts more – I don't want to use the word "prescriptive," but enhanced guidance, let's say, on applications and methods that, you know, they would -- equally will be decision-neutral, if you will.

VICE CHAIRMAN RAY: Systematic might be less –

CHAIRMAN STETKAR: Systematic is probably – yeah.

VICE CHAIRMAN RAY: -- biased than prescriptive.

CHAIRMAN STETKAR: Right.

VICE CHAIRMAN RAY: It's a more positive-sounding word, anyway.

MR. SCHOFER: Yeah, it's not our intent to be prescriptive and we'll get to that point as well a little bit later.

On this slide, it identifies the current practice consistent with NRC guidance. I did highlight already the reg analyses guidelines NUREG/BR-0058.

I pointed to the SECY-77-388A which was the original version of our guidelines. And I do want to point out that they originally were called Value and Impact versus Cost and Benefit.

And it was on this point specifically that the original version was very sensitive to the externalities and the intrinsic things which have to be evaluated as part of policy and rulemaking.

And so, they used those terms, "values" and "impacts," so that there wasn't an overarching, you know, focus on measuring only in dollars. So, a little bit of history.

But simply stated, the NRC guidance directs the staff to quantify benefits and costs of a proposed regulatory action when possible. When it's not feasible to quantify benefits and costs, the staff should discuss non-quantifiable elements in qualitative terms. That's what our guidance says.

MEMBER CORRADINI: But it does it in succession. Again, the only example recently that I remember is the venting strategies where they presented the quantification first and then said, and there are qualitative things to consider, and went through those.

MR. SCHOFER: Uh-huh.

MEMBER CORRADINI: So, it's in some sort of succession. And if there is inability to do it quantitatively, you immediately move to some approaches for qualitative. That's what I'm trying to –

MR. SCHOFER: Sometimes you have the, you know, you're able to quantify some benefits, some costs, but not all of them.

MEMBER CORRADINI: Right.

MR. SCHOFER: And then you have to address the remainder and, you know, to be complete, qualitatively.

In those cases as I outlined the first look at what was calculated and make that comparison, and then do the more complete evaluation.

MEMBER SCHULTZ: And that's reasonably embedded in the value-impact guidelines. That principle has noted the quantitative and qualitative features, the pluses and the minuses of the decision.

MEMBER CORRADINI: Okay, thank you.

MR. SCHOFER: Okay. On Slide 6, I want to talk about the various aspects within the regulatory framework where we do consider qualitative considerations.

And from the high level to the NRC risk-informed decisions, the use of qualitative factors as well as staff, which was in the decision-making process, the Commission Safety goals and PRA Policy Statement both discuss importance of qualitatively considering factors specifically calling out defense-in-depth Reg Guide 1.174 which is one of the guides for PRA, notes that decisions are expected to be reached in an integrated fashion considering traditional engineering and risk information and may be based on qualitative information, as well as quantitative analysis and information. This is really consistent with what our guidance is as well.

However, in this reg guide, they provide more information in terms of how to apply, when to apply than we currently have in our guidance.

At the next level, you know, you have adequate protection determinations. And as discussed in SECY-12-0110, which was the economic consequences paper, the consideration of economic consequences is part of NRC's regulatory framework.

Adequate protection determinations are limited to public health and safety and common defense and security matters and are determined at the discretion of the Commission.

So, within the determination, you know, qualitative consideration of factors have been used before. And we have a whole enclosure that provides history in the last 15 years of where they were applied.

And we point out that, you know, the only related quantitative measures, you know, for looking at backfitting, for instance, is the power reactor safety goal.

On the material side, we don't have a similar criteria that can be applied and the reactor safety goal is a surrogate to the QHOs.

When regulatory action is needed and determined that it is used for beyond adequate protection requirements, you know, we look to the backfitting procedure and cost-justified substantial safety enhancements.

And NUREG-1409, which is backfitting guidelines, states that the backfitting rule does not require a strict quantitative analysis.

So, again, within backfit determinations, the use of qualitative consideration of factors is allowed.

MEMBER CORRADINI: So, can I just go back to the first bullet? You don't have to go back if you don't want to, but on the first bullet you noted – or at least I got the impression that 1.174 has an integrated approach.

Is the deficiency there that it doesn't have standard methods, or that some of these methods aren't applicable to the non-power reactor applications?

MR. SCHOFER: No, the point I was making is that within the PRA guidance they're using fundamentally a similar approach in terms of completeness. They quantify and they also use qualitative information as well.

And they provide, you know, guidance in terms of how to integrate that information as part of that analysis.

MEMBER CORRADINI: So, is there a deficiency there, or is it –

MR. SCHOFER: I'm not saying there – I'm just saying that in comparison to the reg analysis guidelines, we don't have as much in terms of the descriptions of the how, why of that integrated discussion.

MEMBER CORRADINI: So, I guess, and since

I was in the subcommittee, maybe I'm treading over old stuff, why not adopt what's in 174 into the other approach if it's, as I understand it, relatively reasonable?

MR. SCHOFER: With that, I can go to my last slide.

(Laughter.)

VICE CHAIRMAN RAY: Again, the way I find it easiest to think about is just the need for a methodology that will result in systematic, transparent and consistent decisions that people can understand.

And once again I want to point out I just accessed it here to look at all of the examples that aren't power reactors where this set of methods is needed for this reason. So, we don’t want to – unless we deliberately do so and say, well, I only want to talk about this as applied to power reactor safety, but in general it’s a broader – I’ll acknowledge the speaker here in a second – it's a broader subject matter. And you'll see that in Enclosure 1 as you look at it of the paper.

And we have someone who wants to speak.

MR. HARRISON: I'm Donny Harrison from the new reactors, actually, staff, but just to be aware there is an SRM from the Commission also asking the staff to enhance the description criteria for defense-in-depth within Reg Guide 1.174 as well.

So, within the power reactor community, there's a need to enhance that guidance and there's a part of risk management regulatory framework development and a number of activities that are associated specifically with better establishing guidance for defense-in-depth.

MEMBER CORRADINI: Okay, thank you.

MR. SCHOFER: And Dr. Ray gave me a great segue to Slide 7. Enclosure 1 provides a list of past NRC regulatory actions that rely upon the qualitative consideration of factors. And you'll see it's a fairly long list.

Included in the enclosure were examples, you know, some of the factors that were used or that were considered qualitatively. So, that was provided. And some of the examples are provided here, but there is a complete list in the enclosure.

VICE CHAIRMAN RAY: Well, for example, physical protection of a radiated reactor fuel in transit.

MR. SCHOFER: Yes.

VICE CHAIRMAN RAY: Okay.

CHAIRMAN STETKAR: There's a lot of security-related issues here that, you know.

VICE CHAIRMAN RAY: So, it's just we got to keep in mind in a broader sense than we often do when we're just talking about power reactor safety.

MR. SCHOFER: Yeah, we use this across the board for anything that we're imposing a national burden on the public or stakeholders. And so –

CHAIRMAN STETKAR: That enclosure I found was really, really useful because I sort of did my own little mental exercise of going down through each of those items and saying, well, you know, is there any way that I could apply, you know, at least the business that I'm familiar with, quantitative risk assessment techniques? And even stretching, I could get to perhaps a little less than half of them.

So, Harold is right. I mean, this is much broader than quantitative risk-informing licensing decisions for the power reactor community or even if you want to extend it to, you know, other types of fuel facilities.

MR. SCHOFER: Okay. Today I'll talk about what we do within NRC. We also look external to the NRC in terms of what other federal agencies and international agencies do. And we find that we're very similar.

I have a number of documents identified here; Executive Order 12866; Office of Management and Budget; Circular A-4, Regulatory Guidance; Office of Information and Regulatory Affairs, OIRA, which is part of Office of Management and Budget, and they provide a regulatory impact analysis, A Primer, and all of them note the importance of consideration of both quantitative and qualitative factors.

We also looked internationally and there is a report that we note that discusses economic consequences and methodologies for evaluating. And although the focus is definitely toward quantification, they also discuss the importance of qualitative consideration of factors.

And there is a public version of that document and it's included as one of the references.

VICE CHAIRMAN RAY: Recognizing that I think we all readily accept what you're saying and what you've found, is there anybody else who has a set of methods using that terminology from the proposal that is a potential example of what we're talking about?

In other words, these other references, yes, they say consider other than quantitative factors, but they also say how to do that in a way that's systematic, transparent and consistent.

MR. SCHOFER: Department of Homeland Security does a lot of break-even analysis, as you might imagine.

VICE CHAIRMAN RAY: Yes.

MR. SCHOFER: EPA, cost-effectiveness, break-even, I mean –

VICE CHAIRMAN RAY: But they tell the analysts how to do it in the way that we're contemplating?

MR. SCHOFER: Yes.

VICE CHAIRMAN RAY: Okay. So, we're not inventing the wheel, something new or different here.

MR. SCHOFER: No, these are pretty standard techniques. I mean, we're just bringing them in so that there's a handy reference.

CHAIRMAN STETKAR: You think Bureau of Reclamation, you know, Army Corps of Engineers, you know. The Corps has got to be involved in that type of stuff.

VICE CHAIRMAN RAY: Okay. So, we're not trying to advance the technology here of doing this. We're just going to try and adopt it for what we do.

MR. SCHOFER: Uh-huh. This slide is part

of a click or two and it just displays OMB, you know, annually does a report to Congress on benefits in cost-effective regulations.

And in the 2013 report which was looking at fiscal year 2012, which was the most current at the time we were doing the paper, 2014 I think is now out, you know, they looked at the major roles.

The major roles are, you know, have impact on society of annual costs of a hundred million dollars or more and has some other criteria. So, these are really big roles.

And you can see, you know, with the color scheme, blue, red and green. Blue, they monetized benefits and costs. Red, they monetized costs only. So, all the benefits are considered qualitatively. And green, they monetized benefits only, and so costs were qualitatively considered.

You can see roughly half of these major roles done by, you know, federal agencies rely heavily on, you know, qualitative consideration.

MEMBER CORRADINI: So, going that route if you made a pie chart for NRC, how would it look?

MR. SCHOFER: Probably about the same.

MEMBER CORRADINI: Oh, would it? Okay.

CHAIRMAN STETKAR: Look at that Enclosure

3.

MEMBER CORRADINI: This is Enclosure 1.

CHAIRMAN STETKAR: I'm sorry. Enclosure 1, you're right.

MR. SCHOFER: You know, more on the material side you have very similar to the red monetized costs only. And it's more difficult to quantify benefits.

Security, safeguards-type similar, you know. Transport which was also brought up similar to that. Reactor side, we tend to be more in the blue.

VICE CHAIRMAN RAY: Mike, if you – I'm just looking here at what Mike Snodderly sent out on August 7th. If you happen to have it, you can easily pull up Enclosure 1.

CHAIRMAN STETKAR: It's a really neat summary. I mean, you don’t have to – there are links to every one of the detail things. But if you just look at the titles and think about them, it's pretty interesting.

MR. SCHOFER: All right. This slide, I guess Slides 10 and 11, discuss specific scenarios that helped us organize our thinking as we prepared this paper, thought through the issue to come up with the proposed recommendation.

We have four scenarios. And you can see, you know, the first scenario, you know, benefits cannot be quantified, presented only qualitatively, costs are quantified, which is very similar to the prior pie chart. And past applications are identified.

Scenario B, you know, benefits quantified, others qualitatively considered, costs are quantified and the net benefit of the quantitative analysis is positive.

I probably should address, you know, Dr. Schultz' issue. When we went through this, I mean, we were thinking about, you know, the scope of the SRM. And it drove us to address, you know, the – when quantitative benefits are positive.

If they're negative and you have, you know, a negative cost-beneficial determination, the decision is pretty clear.

You could potentially have the same issue where you believe that from a quantification the net benefit would be positive. If I could have some negative qualitative consideration arguments, that would be similar to this, but I don't think we've come across that.

CHAIRMAN STETKAR: Well, but in principle, you could, Fred. I mean, if you did an uncertainty evaluation on the quantitative and it showed, you know, marginal positive with uncertainty skewed toward negative, then qualitative considerations could take another direction.

MEMBER SCHULTZ: In principle, you always do. We make decisions everyday which we don't quantify and we have the qualitative yeses and the qualitative nos of the cost and the – and we make the decision. And when we decide not to do something, then the negatives outweigh the positives.

So, the same thing happens in decision-making in the regulatory evaluation process.

MR. SCHOFER: Yes, I agree. I mean, it was just that this was more stylized to help us –

MEMBER SCHULTZ: I understand. I understand how it fits into the examples.

MR. SCHOFER: And probably one point I want to make, you know, failure to monetize some benefits make it more difficult to fully understand the economic tradeoffs. I mean, I think we all agree with that.

The staff acknowledges that there are challenges to completely monetizing both benefits and costs for all considered regulatory actions. And I think that point was made by Dr. Stetkar and others in looking at the enclosure.

MEMBER CORRADINI: So, on another note, so since you're looking at qualitative – or relooking at qualitative and how to provide appropriate guidelines and methods, I assume – well, maybe not. You’re not going to look at benefit and cost analyses and how you do that to include that.

MR. SCHOFER: No, that’s not –

MEMBER CORRADINI: I know the –

MR. SCHOFER: The scope of this paper was not to do that.

CHAIRMAN STETKAR: But there is, Fred, there is still, I mean, you're updating – I forget the numbers to –

MR. SCHOFER: EPRI update two which is DAC passed.

CHAIRMAN STETKAR: And part of the --

MR. SCHOFER: And this is such a small piece.

CHAIRMAN STETKAR: Yes. Part of that is updating, for example, the – oh, I’ve forgotten it. Economic consequence evaluations.

MEMBER SCHULTZ: How one does the metrics.

CHAIRMAN STETKAR: How one does that.

MEMBER SCHULTZ: Performs the unit costs and so forth.

CHAIRMAN STETKAR: So, this is just part of the update of the overall regulatory analysis.

MR. SCHOFER: This is really such a thin slice of what we do.

(Speaking over each other.)

CHAIRMAN STETKAR: I was going to say occasionally it gets visibility, though, doesn't it?

MEMBER CORRADINI: Okay, thank you.

MR. SCHOFER: Okay. And, you know, as I was indicating that, you know, monetizing both benefits and costs for all considered regulatory actions is a major challenge. I mean, I think we can all agree.

But when it's not possible to monetize all impacts, qualitative analysis and then monetized impacts provide the best available information to communicate the impact.

So, it's evaluating, you know, a completeness evaluation of both quantitative and qualitative is very important.

Scenario C and D is really more toward the focus of the paper. Scenario C, you know, some benefits are quantified, others are qualitatively considered. Costs are quantified. The net benefit is negative.

And so, do the qualitative arguments make it such that we should go forward, or flipside talking about let's say the benefits are quantified, but the costs are qualitatively considered. The same thing could happen. And so, it's that particular one.

And then you have Scenario D where some benefits can be quantified, others are qualitatively considered. Costs are quantified and whether to do only part of what we currently do, which is compare the quantitative information, but only include the qualitative information for information which seems to be only providing part of the answer.

So, after you're going through all the history, you know, so everyone is on the same page with regard to, you know, what has been done, why we did it, also looking at, you know, external to the NRC, you know, other federal agencies in our national community guidance provided by Office of Management and Budget, you know, we came up with the following conclusions.

The first is simply NRC guidance directs the staff to quantify benefits and costs of proposed regulatory action when possible.

When it's not feasible to quantify benefits and costs, the staff should discuss the non-quantifiable elements in qualitative terms.

And as I also indicated, you know, failure to quantify attributes make it difficult to fully understand the economic tradeoffs. And when it's not possible to monetize all impacts, you know, the best answer is to do the integrated evaluation, the qualitative analysis of the non-monetized impacts with the quantitative results and information to provide the best available information to communicate the impact. And that's really the key point.

I mean, so, this practice is aligned with other federal agencies, the international community. And as such, you know, by going through the background and looking at how qualitative factors were considered, the staff believes that, you know, possibly, you know, the next step would be developing additional guidance to clarify a potential tool and the hows, whens and whys of the use of qualitative consideration in our assessment.

MEMBER REMPE: Fred, before you go to the next slide – are you done with that?

MR. SCHOFER: I'm done.

MEMBER REMPE: I saw you turn the page, but

I was looking at the slides from the subcommittee meeting and comparing them to the slides today. And there's been a couple of places where you've added comments about the current guidance emphasizes the need to make efforts to quantify reasonable costs and benefits. So, that's kind of been changed from your earlier presentation.

And I guess when I see this bullet, what I wonder is how do you decide what a reasonable effort is? Where is the cutoff where you say I just can't do it, and you throw up your hands?

Can you maybe give your thoughts on that?

MR. SCHOFER: Sure. When we, you know, get involved, we get involved very early and we tend to develop a plan in terms of how we're going to approach the reg analysis and, you know, where we're going to collect data from and what some of the sensitivities might be or, you know.

And so, as we put together the plan, you know, and we start evaluating where are we going to get the information, you know, if the information is not readily available, you know, what will it take to acquire it or develop it and how it's entered into the overall plan for whatever activity we're looking at.

And so, as you know, I mean, in some cases things, you know, there is not data or there is not sufficient data to quantify or there may not be acceptable models or there could be a whole slew of things that might be issues in terms of quantification.

So, they're identified early and we start, you know, communicating that with the Agency and, you know, a point is made where we say this is what our plan is going to do and this is what we're going to quantify.

VICE CHAIRMAN RAY: Fred, you might –

MR. SCHOFER: Well, if I can just –

VICE CHAIRMAN RAY: Oh, I thought you were done. Excuse me.

MR. SCHOFER: In some cases, you know, we'll make that point and people say that's not, you know, enough. Do more. Okay, that's fine. We'll do more. In other cases, it's believed that that will be sufficient and we'll go with that.

Now, for instance, the containment vent paper, fundamentally the Commission told us that what we did was not sufficient and they told us to do more.

So, we have another, you know, we have a tasking to do containment filtration which is doing the evaluation again. And personally, that was because one option was not fully fleshed out at the – in the 2012 timeline.

I mean, it was kind of the concept that you could do, you know, water management and there's a lot of mechanisms in containment that would allow the removal of sufficient source term such that should you have a release, you know, it would be not cost-beneficial to do more of that.

So, we're doing it again. And as a result of that, we're doing a lot more quantification and, therefore, probably have less qualitative arguments and those types of things.

We'll have some, but some of the broad ones that we had in the first cycle will not be there.

VICE CHAIRMAN RAY: Well, I think on this point that Joy raises, the paper does identify three disadvantages of undertaking this effort.

Two of them have specifically to deal with the point that I think you're illustrating in this case, and they are the increased staff resources needed as a result of, first, developing and, secondly, implementing these methods.

And the point would, I think, be in response to what she said and what you said, is, well, it's always going to be a judgement. That's what management does is decide how much is enough. How much resources are we going to put into this particular answer that we're seeking?

And I don't know that – maybe as we go forward and see what the methods turn out to be, we can be more definitive as to how far is far enough. But at this point in time, I think it's acknowledged in the paper that there's going to be an impact on resources because we are going to be more systematic, more transparent, more consistent.

And that's going to have a cost and at some point we're going to say that's as much as we can do, but it's too big right now.

I mean, there's nothing more to say than observe, well, that's going to have to be a decision made case by case as I see it.

There's no way to draw a line and say, well, this is how far you have to go. And when you've gone that far, that's far enough.

MR. SCHOFER: Sure. But on the flipside of that as well, I mean, the analyst has to address that on an ad hoc basis now. I mean, they have to make those determinations –

VICE CHAIRMAN RAY: Right.

MR. SCHOFER: -- you know, develop the

plan, you know, justify their, you know –

VICE CHAIRMAN RAY: But we're going to do it in a consistent and transparent way –

MR. SCHOFER: Correct.

VICE CHAIRMAN RAY: -- as a result of this effort. And that's the main point, I think, that needs to be –

MR. SCHOFER: And so, you know, what we're looking for is to provide that additional, you know, touchstone so that the analyst knows, you know, how to approach it more systematically as you indicated, and to provide additional tools that in developing the qualitative arguments, that has more structure that, you know, as they go through that, the process that they are, you know.

VICE CHAIRMAN RAY: Yeah. And the record will be more –

MR. SCHOFER: Complete.

VICE CHAIRMAN RAY: -- complete and understandable by those who are reviewing it. But the answer to how much is enough, I don't think there's an answer to that question because it's very dependant on what the heck you're talking about.

MR. SCHOFER: Well, we answer that question every time. It's just on a case-by-case basis.

MEMBER BLEY: Yeah, I'd like to toss something in here, Fred, and it's reiterating something from the subcommittee meeting. To me, that question is an almost irrelevant question.

The one thing I hope you do before you're all done is present the product in an integrated fashion. And when you do that, this question of how much is enough kind of goes away, because you work your way to a sensible point.

I've read far too many quantitative analyses that don't provide the supporting qualitative information to convince me that they've considered the right factors, that they've considered the things affecting those factors and that they've considered all the sources of information to bring to the problem.

So, the structure in my mind is always – begins with qualitative analysis laying out the logic of what you're doing, why you've picked the things you've picked, and then looking to see do we need to quantify, do we need to – how do we structure this to make a decision?

And that either leads you into quantification if there is sufficient information, or it leads you to picking some qualitative/semiquantitative way to structure the results that all ought to begin with that good qualitative analysis.

And when you say we sometimes have to go quantitative, sometimes when we do that, we forget what we did qualitatively and we lose that impact, that importance and that gives us a whole structure. So, I hope you eventually get to that point.

And then I think the other question kind of solves itself. You see what you've got and you see if it's worth doing – it's much easier to see if it's worth doing more effort.

MR. SCHOFER: Yes, and thank you for that. When I refer to that kind of consideration, you know, starting qualitatively and start planning it out, I call that the plan, you know, in terms of how you're going to approach that.

MEMBER BLEY: That's fine, yeah.

MR. SCHOFER: And you decide which attributes are most important and which ones may not participate. So, that initially.

And then you go into the attribute and say, okay, what within that attribute would be affecting this out. And then you kind of build your –

MEMBER BLEY: I think what you're doing

will help our quantitative analyses, because it will – if you present it that way including your plan, because that will give us much better quantitative reports in the places where we actually use that.

CHAIRMAN STETKAR: I think that's an important point. Because as the SECY paper, you know, in a kind of traditional incarnation of these things and the regulatory analyses precedes, there tend to be two distinct, you know, there's the quantitative analysis and we know how to do that because that's cost and benefits and we can quantify some sort of, you know, surrogate for quantitative health objectives and we do that.

And even in the SECY paper, it immediately lists – there's a whole Enclosure 3 about, you know, how to do qualitative analysis with one of the methodologies that are the analogy of, you know, the tools that we use for the quantification.

What Dennis is talking about is a much more integrated presentation of how most of those things are used. So, it's broader than just saying, well, go forward and develop, you know, guidance for the appropriate method to select from Enclosure 3 for things that we're going to call qualitative evaluations.

VICE CHAIRMAN RAY: Well, we're going to look forward to the next step hopefully which is to look at an example.

CHAIRMAN STETKAR: I think what Dennis is saying, though, is it’s broader –

VICE CHAIRMAN RAY: I’m not –

CHAIRMAN STETKAR: It's broader than just picking off this one slice, as you mentioned, of the regulatory analysis process. It's really folding everything together in a whole – the whole update to the regulatory analysis guidance.

VICE CHAIRMAN RAY: I'm still wanting to see something tangible not that I disagree with Dennis, it's been said I don't, but it's going to be interesting to apply it.

It's going to be probably an important task to pick the right few applications so that we don't waste time on things that aren't good examples of the application we're talking about and take a look at are we satisfying what Dennis has said or not.

MEMBER REMPE: So, earlier you mentioned there were examples, the Department of Homeland Security, Army Corps of Engineers, et cetera.

Are any of those examples something that would reflect what Dennis is suggesting, an integrated qualitative/quantitative approach?

MEMBER CORRADINI: Yes, in other words, pick something that's not close to home so that if we didn't like it, we could still look at it and both criticize it and compliment it.

MR. SCHOFER: Okay.

MEMBER SCHULTZ: Those are better examples of where qualitative factors are considered. The types of qualitative evaluation processes are, if you will, somewhat scattered in terms of application.

MEMBER BROWN: Real examples weren't readily available to show –

MEMBER SCHULTZ: That's right.

MEMBER BROWN: -- the details of how they walked through that.

MEMBER SCHULTZ: But this is something that I agree with Dennis that if we look at it from a real top-down approach in the first place and use it in a way to enhance the entire process, the quantitative and the qualitative and the merger of the two, then we will have accomplished something.

MR. BROWN: Well, my major concern, and we talked about it in the subcommittee meeting, was your bullet one, two, three, four, five in that my perception of that discussion we had was that the qualitative consideration of factors can be arbitrarily weighted and, in other words, too much emphasis has been applied to qualitative.

And I worry about that, that we're going to dump the qualitative and now everybody is going to get into their little monetized menu and they're going to – the qualitative factors are always going to have this arbitrary downside.

In my mind, there's some circumstances where, quite frankly, I hate to refer to my old program, where the qualitative aspects were so overwhelmingly obvious that, yeah, it was going to cost us some money, but we went ahead and did it anyway.

So, it was a negative cost thing, but yet just the perception of what we were dealing with drove us to make those decisions and go back and do something.

And I'm worried about that getting downplayed in this whole thing about how do we – how do we weigh the qualitative parts and then all of the sudden we start – these little factors get thrown in and they're on the low end instead of on, you know, where they ought to be considered.

And I like Dennis' comment. It was very,

very good in terms of how you start from the top qualitative and look at how you want to do stuff, and then figure out where quantitative is going to provide value added in the decision process, not quantitative is the thing and then figure out where qualitative is going to provide it.

VICE CHAIRMAN RAY: The paper, I think, recognizes this explicitly. It says, as another disadvantage of even doing this, which is what you're talking about –

MR. BROWN: Yes, exactly.

VICE CHAIRMAN RAY: -- is the qualitative consideration of factors remains subjective. Doing this may imply objectivity by formalizing the process.

MR. BROWN: Exactly.

VICE CHAIRMAN RAY: And the implication of objectivity would be the downsizing that you're talking about.

So, but this is so ethereal at this point in time that to me we'll really need some applications to look at before we know have we – are we on the right track or not.

MR. SCHOFER: Well, you mentioned previously about, you know, are there other examples external to the NRC that could be discussed and I'll throw one out.

Department of Transportation did a rule for backup cameras for your cars. And the item was, you know, how can backup accidents be decreased?

So, they considered, you know, status quo, you know, the standard mirror system that you have on your car, they considered an alternative which was require backup cameras on all new cars, and they also considered, you know, requiring sensors and additional mirrors on the cars or bigger mirrors or whatever to, you know, address that problem.

Backup cameras were not cost beneficial. However, the rule was promulgated. And it was promulgated based upon qualitative arguments.

And some of those qualitative arguments included, you know, there was statutory compliance, there was an act, the Cameron Gulbransen Kids Transportation Safety Act.

VICE CHAIRMAN RAY: Congress said so, in other words.

MR. SCHOFER: There was the value of a child's life, you know, children have a higher value of statistical life than adults.

They used dread, the psychological impact of an adult or a parent guarding over their child.

They recognized distributed impacts which was that the people that were most adversely affected by backup accidents were children and the elderly. And they also addressed simplified parking and convenience.

VICE CHAIRMAN RAY: Okay.

MR. SCHOFER: As an example.

VICE CHAIRMAN RAY: Yeah. But, again, we're talking about a set of methods and we don't – I don't think we can say much until we see something that there's more change.

(Simultaneous speaking.)

MR. SCHOFER: So, our proposal is that, you know, given that there are instances where it's not possible to monetize all impacts, the history of use of qualitative factors and their importance, we, the staff has proposed, you know, updating cost-benefit guidance to include a set of methods with the overall goal of, you know how can we do it better, how can we be more systematic, how can we make our practice more transparent, how can we be, you know, more consistent across business lines.

And based upon the research, the staff recommends updating the cost-benefit guidance to include information on how and when qualitative factors should be used, how the results will be incorporated into an integrated analysis that brings an argument in support of a particular alternative.

VICE CHAIRMAN RAY: There's no schedule presented.

MR. SCHOFER: This would be part of the 14-002 update.

VICE CHAIRMAN RAY: Yes.

MR. SCHOFER: We will be looking for Commission approval to go forward with this plan and then we would incorporate into that activity.

We're looking for 14-002 or the NUREG-0058 which will be the home –

VICE CHAIRMAN RAY: Right.

MR. SCHOFER: -- that will be draft, you know, draft available in the, you know, fiscal year 2015. So, that will be something that will be coming up this year.

I would anticipate that would be coming in front of you, as well as we would be issuing that for public comment as a new NUREG or revised NUREG. So, there would be, you know, that cycle that we would be going through.

CHAIRMAN STETKAR: And we already have a subcommittee meeting scheduled and I can't remember whether it’s November or December on the –

MR. SCHOFER: We have a subcommittee October for –

CHAIRMAN STETKAR: Is that –

MR. SCHOFER: – analysis.

CHAIRMAN STETKAR: Yes.

MR. SCHOFER: That is looking at how we perform regulatory analysis backfit – or cost-benefit, you know, in regulatory analysis backfit, NEPA analysis across the Agency.

Also, looking externally to see what other lessons can be learned that might be potential policy issues and identifying those gaps and that will feed into Phase 2 of the 14-002 product.

VICE CHAIRMAN RAY: That was part of the cost-benefit, yes.

CHAIRMAN STETKAR: Yes.

MR. SCHOFER: That concludes my presentation. The next few slides are pretty much references.

VICE CHAIRMAN RAY: Pretty much.

MR. SCHOFER: Pretty much. And I am willing to take any additional comments or questions.

VICE CHAIRMAN RAY: Anything for the presenters?

(No response.)

VICE CHAIRMAN RAY: All right. Well, thank you, Fred – oh, you have one. Sorry. You're not raising your hand high enough for me to see it.

(Comments off record.)

VICE CHAIRMAN RAY: We do want to make sure that we ask both anyone here in the room and then anyone online.

Is there anyone attending the meeting today that would like to ask a question – or make a comment. Excuse me. Like to make a comment.

(No response.)

VICE CHAIRMAN RAY: Seeing none, and we'll ask then if the line is open.

MEMBER CORRADINI: If anybody is out there, say something.

VICE CHAIRMAN RAY: If there's anyone on the line, we'd appreciate your acknowledging that you can hear us.

MR. LEWIS: Marvin Lewis.

VICE CHAIRMAN RAY: Thank you, Marvin. Appreciate it. Good morning to you. Is there anyone –

MR. LEWIS: Good morning.

VICE CHAIRMAN RAY: Is there anyone who would wish to make a comment on the presentation we've just received?

MR. LEWIS: Yes, I would, really, but it's kind of negative.

VICE CHAIRMAN RAY: Go ahead. We're just taking comments. So, whatever comments you'd like to make.

MR. LEWIS: Yeah, the point is that here's a staffer coming in for guidance, but the guidance is about how much effort is put on something.

So, the point is, you do have deciding factors to look at. Namely, your charter, which states specifically nine times, protect the health and safety of the public.

I do not believe you have a right to give something up just because it is difficult in any way, shape or form in terms of safety of the public. Thank you.

VICE CHAIRMAN RAY: Okay. All right. We have received that comment. Thank you for that. If there's any other comments, we'd be glad to receive them now, too.

(No response.)

VICE CHAIRMAN RAY: Hearing none, then I'll turn it back over to our chairman and thank you for your presentation.

CHAIRMAN STETKAR: Thank you. And thanks, Fred and Aby. Good presentation. Good discussion.

Because this is a full committee meeting, we need to hit our marks on the schedule quite well. And I know folks are still working on versions of draft letters so that I think what we'll do in the interest of giving people time to do a little bit of work, is we will recess until 10:45 and reconvene then.

(Whereupon, the above-titled matter went off the record at 9:38 a.m. and went back on the record at 10:44 a.m.)

CHAIRMAN STETKAR: We are back in session. Our next topic on our agenda is a draft generic letter. And because I was surprised about having numbers for the SECY paper, I will not say the unnumbered draft generic letter on Monitoring of Neutron Absorber Materials in Spent Fuel Pool.

And Ron Ballinger will lead us through this session. Ron.

MR. BALLINGER: Good morning. Good morning. On August 21st, 2014, the Metallurgy and Reactor Fuel Subcommittee was briefed by the NRC staff and NEI on neutron absorber degradation in the draft generic letters – proposed draft generic letter.

The topics discussed on that day were nuclear criticality analysis, technical perspective on spent fuel pool neutron absorbing material degradation, background on the generic letter, generic letter information request and NRC's response to public comments on the draft generic letter. We also heard industry's views on the generic letter and ongoing industry efforts. NEI was also kind enough to bring some samples for us to observe and play with, I guess.

Degradation of neutron-absorbing materials used in the spent fuel pool is a potential safety issue that nuclear power reactor licensees have been dealing with since the 1980s. In particular, Boraflex.

Recent events have raised concern among the staff that some licensees may not have adequate methodologies and surveillance programs to monitor and assess the degradation and deformation of neutron-absorbing materials in the spent fuel pool.

The draft generic letter is asking licensees to provide information regarding their neutron-absorbing materials monitoring programs and the basis for them.

The NRC staff believes that licensees

should have this information available under 10 CFR 50 Appendix B record-keeping requirements.

The generic letter is not requesting any new analysis programs or research. Today we'll get the condensed form of the presentations that were given to us on August the 21st.

We will now proceed with the meeting and call Tim McGinty, director of NRR, to give a brief introduction and introduce the presenters.

MR. McGINTY: Thank you, Dr. Ballinger. I am Tim McGinty. I'm the Director of the Division of Safety Systems in NRR. I and my staff really appreciate this opportunity to brief the Committee. My remarks are actually – align fairly well with Dr. Ballinger.

The degradation of neutron-absorbing materials used in the spent fuel pool is a safety issue that nuclear power reactor licensees have been dealing with since the 1980s. For example, Boraflex.

Recent events have raised concerns among the NRC staff that some licensees may not have adequate methodologies and surveillance programs to monitor and assess the degradation and deformation of neutron-absorbing materials in spent fuel pools.

Licensees submit criticality analyses to the NRC as part of the license approval process to demonstrate that they meet NRC subcriticality requirements. Many licensees credit neutron-absorbing materials for this purpose.

The NRC has recently seen situations where licensees found previously unidentified degradation of neutron-absorbing materials or have ineffective monitoring programs for their neutron-absorbing materials.

In several cases, the neutron-absorbing materials were found to be outside the bounds established by the assumptions of the criticality analysis of record.

This is not an immediate safety concern. However, it is a safety concern. Unidentified and unmitigated neutron-absorbing material degradation constitutes an unchecked reduction in the subcriticality margin which has the potential to lead to local criticality in the spent fuel pool.

As Dr. Ballinger mentioned, this generic letter is asking licensees to provide information regarding their neutron-absorbing material monitoring programs and the basis for them.

The staff believes the licensee should have this information available under 10 CFR 50

Appendix B record-keeping requirements. This generic letter is not requesting any new analysis, programs or research.

Thank you for that opportunity. At this stage, I will be willing to turn it over to Scott Krepel and Matt Yoder.

MR. KREPEL: Thank you, Tim.

My name is Scott Krepel and I work in the Spent Fuel Team that's located in the Reactor Systems Branch, Division of Safety Systems in the Office of Nuclear Reactor Regulation.

I'm the technical lead for this. I'll be also presenting with Matt Yoder. He is a chemical engineer in the same Office of Nuclear Reactor Regulation.

We're going to be providing an overview of our presentation to the subcommittee that was on August 21st.

We have some – four different sections that we'll be presenting. First, I'll be providing some background information on the criticality analyses for neutron-absorbing material and the criticality criteria.

And after that, we'll get some background. Then Matt is going to present regarding specific neutron-absorbing material concerns that the staff have noticed. We will be passing out some samples of material at the same time for you to look at.

After that, we'll also focus on providing some operating experience events that NRC has seen up to this point, and then approaches that we can have that we've identified to – I'll go back a bit here. Past efforts by NRC staff in order to address some concerns that we've identified.

Finally, then we'll focus on getting to the key point of this presentation today, discussing the generic letter and how that is a means to address these concerns.

All right. First of all, the regulation criteria for the criticality analyses is found in 10 CFR 50.68. And also in the General Design Criteria 62.

The program is – its intent is to prevent any inadvertent criticality events in spent fuel pools.

General Design Criteria 62 provides some general guidelines on how the spent fuel pool should be designed to prevent any kind of criticality events, but the important criteria that we're focusing on usually is in 10 CFR 50.68, which provides specific limits on decay effective for the spent fuel pools.

So, we'll get into some -- in summary, we'll see what the licensees are – for decay effective -- decay effective is less than 0.95 for the 0.95 assurance and confidence. And there's more research on that, but we'll go into detail on the specifics of that.

Some plants, however, licensees are under the same regulations of – are exempt. They're exempt, however. But in general, the regulation's limits are the same.

MEMBER BLEY: I'm sorry. I missed the chart on that. They're exempt from what?

MR. KREPEL: Okay. Let me go back a bit. Previously, the past licensees were under 10 CFR 70.24. And a lot of licensees requested exemption from that by submitting the criticality analysis to prove that they could be subcriticality. There's a lot of margin left.

So, then later on when they set up the 10 CFR 50.68, that was regulated, but there was one or two licensees in the area that still have exemptions in that area, but they're still under the same regulation.

MEMBER BLEY: Thank you.

MR. KREPEL: All right. I'm going to go back one more slide. I'm almost done with it. Don't worry.

Okay. The important key point is that the licensees submit the criticality analysis which shows that with the spent fuel pool calculation, the geometry, all of the material components to make sure that the guidelines are met, the licensees are using their neutron-absorbing materials in the spent fuel pools to show – and help them to show that they are meeting the limits.

The key point, though, is that if the neutron-absorbing material credits are in the criticality analyses, it needs to be also for the neutron-absorbing functions as explained in the criticality analysis.

Now, we're here today because there are two concerns about some potential regulation compliance issues and safety issues regulating to the neutron-absorbing materials that tend to be in the spent fuel pool.

The criticality analyses have about half of a percent delta K in the margin to the regulatory limit, but the most important measurement to the neutron-absorbing materials possible to do – is it possible for them to do their function is the Boron 10 areal density, because Boron 10 is a primary means by which the material-absorbing neutron, they can have that safety function.

Normally, in a criticality analysis is modeled by Boron 10, the areal density is a minimum value that also incorporates – it's incorporated into the acceptance criteria for the neutron-absorbing material.

We have a chart here that shows this curve that shows the reactivity impact. Also the areal density as it decreases for the boiling water plants in the spent fuel pool.

MEMBER CORRADINI: Can I ask a clarification just so I understand? So, this is the delta K infinity as a function of –

MR. KREPEL: Areal density.

MEMBER CORRADINI: Decreasing areal density, right? I'm decreasing going to the right.

MEMBER BLEY: It's hard to read the scale.

MR. KREPEL: Yes, you're right. If you move to the right, the areal density is decreasing.

MEMBER CORRADINI: Okay. So, my question is, and I don't know any of the regulations. So, we'll just put that aside, but my question is just technically, so the delta K infinity is going up as you go to the right, but am I still substantially subcritical, or is there a concern of going critical? That's what I'm asking.

I can understand how the uncertainty would go up, but am I starting to cross some sort of – am I approaching anywhere close to K infinity 1? Is there another way to – do you understand my question?

MR. KREPEL: Yeah, I think I understand your question. I think that here you ask how this fits in with the subcriticality margin –

MEMBER CORRADINI: Correct.

MR. KREPEL: -- in the pool.

MEMBER CORRADINI: Thank you, yes.

So, you don't have to answer now, but that's what I – what popped up when I saw your curve.

MR. JACKSON: My name is Chris Jackson if I can just jump in with my perspective. I'm acting in another capacity, but I was the branch chief of Reactor Systems before and I will be again. I'm a once and future branch chief.

So, as you move to the right on this chart, the point of this chart is to show that it's a nonlinear -- as it degrades, you know, the initial impact is small. But as you degrade it more, the impact is larger. So, each pool has its own inherent margin.

There's margin required by the regulation. So, as you move to the right, you could be challenging the regulation first, and then the actual subcriticality.

So, at some point it creates a problem. We're not within the requirement.

MEMBER CORRADINI: But – okay. So, last question.

MR. JACKSON: We don't expect or we're not suggesting that we would have it if somebody is crediting, you know, 0.22 grams per square centimeter that will go down to zero.

What we wanted to do is this a no, never mind from a safety standpoint, or at some point does this become a safety issue?

This tells us that at some point it does become a safety –

CHAIRMAN STETKAR: But on the other hand on this plot, the right-hand margin is zero. So, the question is at zero, where are you in terms of criticality margin?

MEMBER CORRADINI: Yeah, so my follow-on question was for bounding, would it just be vanished?

Am I still having a problem?

CHAIRMAN STETKAR: Right. Well, the right-hand end of this plot is zero.

MR. JACKSON: Because it's a delta K, it's zero.

MEMBER CORRADINI: No, but I’m asking –

(Speaking over each other.)

CHAIRMAN STETKAR: The boron areal density is zero on the bottom on the right-hand side.

MEMBER CORRADINI: So, my question would go something like this: If I'm far to the right and my delta K infinity is 0.3, I'm sure somebody has done a calculation for various pools that if it just magically disappeared tomorrow, I'm still subcritical.

I may not meet the regulation –

MR. YODER: It depends on the specific pool geometry and the spacing of the fuel, okay. So, some pools may have no credit for any neutron-absorbing material, no B-10 areal density, and they're still maintaining subcriticality because of the amount of spacing and the pattern of their fuel in their specific pool.

MEMBER CORRADINI: Okay. So, on a case by case basis, this could be a problem?

MR. YODER: Or they could have soluble

boron in the pool, would be another means to control the criticality.

CHAIRMAN STETKAR: But there could be pools without soluble boron, if I understand what you're saying, where –

MR. YODER: Sure. On the other end of that coin you could have pools that don't have their fuel spaced out adequately enough. And then you would challenge your criticality margins as you move to the right on this diagram.

CHAIRMAN STETKAR: Okay.

MR. BALLINGER: The units on the right axis, that's absolute 0.1, 0.5, 0.2, 0.25, not percent?

THE INTERPRETER: I'm sorry. Could you repeat the numbers, sir?

MR. BALLINGER: The units on the K infinity, delta K infinity axis, are those absolute units?

MEMBER BLEY: The delta K infinity. Ron is asking if it's a percent, or if it's actually 0.2, 0.3.

MR. KREPEL: It's absolute number.

MR. BALLINGER: That's an absolute number.

MR. KREPEL: Actual numbers.

(Comments off record.)

MEMBER SCHULTZ: So, the general margin would be 0.05. In other words, 0.95 is what you need to maintain.

MR. KREPEL: Right.

MEMBER CORRADINI: Is that the –

MEMBER SCHULTZ: At least. At least.

MR. JACKSON: For a boron pool, you would need to maintain K effect at less than 0.95 at a 95 95 confidence level –

MEMBER SCHULTZ: That's right.

MR. JACKSON: -- when crediting boron. And it would have to be less than one, K effect of less than one at a 95 95 confidence without crediting boron even if the pool has boron.

MEMBER SCHULTZ: So, if the degradation is a factor of two, you're approaching where you shouldn't be, the 0.05.

MEMBER CORRADINI: Okay, thank you.

MR. JACKSON: And remember these calculations were done for a specific geometry.

MEMBER SCHULTZ: Exactly. Particular spacing.

MR. JACKSON: Typical fuel for –

MEMBER CORRADINI: That helps. Thank you

very much.

MR. KREPEL: Okay, thank you.

So, the point of this really is to demonstrate how that the reactivity behavior is not really representing all plants. It might be a specific plant. It might be – others can be worse, and some will be better, okay.

The point is that initially at the start, the initial degradation was a compliance issue. But as the degradation increases, then it starts to have more and more safety issues especially related to – you see the curve is going up faster on the right.

Other concerns are with the design basis effect, for example, an earthquake or a loss of spent fuel pool cooling. So, we want to make sure that the materials will be able to function after this event happens.

The NRC staff believe that the key to understanding this is knowing the conditions of the neutron-absorbing material.

Before this presentation, we had discussed how important it was to measure the neutron-absorbing materials and the B-10 areal density that was in a normal model as a minimum effect.

We realize that it was because of the

criticality is a local phenomenon as we have a chart here to show that emphasizes the point.

This happens in Shika, Japan, their boiling water reactor plant. What happened is that they were adjusting the hydraulic full drive and three of the rods lifted out.

So, we see the two rods didn't actually withdrawal out more than half. None of the rods were more than half. One rod was less than 20 percent withdrawn, but the plant still became critical and there was a power surge, power spike.

Now, I want to build on this point and emphasize that in the spent fuel pool, we need to know the local condition of the neutron-absorbing material. We don't believe that we can depend on an average areal density or what conditions are typical in the storage cell.

So, in summary, from the criticality viewpoint, it's important to manage the degradation for neutron-absorbing materials and it's a safety concern in that if it's unchecked, subcriticality margins have the potential to lead to inadvertent criticality events.

So, now, this is the end of discussion of criticality analysis. We'd like to turn it over now to Matt to discuss some specific examples of the neutron-absorbing material.

MEMBER BROWN: All right. But before you do that, you shifted from the spent fuel pool in the discussion and then talked about the Shika reactor pulling rods.

That's not a spent fuel pool. That's a core, right?

MR. KREPEL: Yes.

MEMBER BROWN: Is there a connection between talking about the core and the spent fuel pool? Sorry to be ignorant, I just –

MR. YODER: The intent was to show that you can have a localized degradation in a spent fuel pool and it would have a similar effect to pulling just a small number of rods in a –

MEMBER BROWN: Okay. So, you were just trying to make an analogous –

MR. YODER: That's correct.

MEMBER BROWN: -- condition in a core as opposed to what you – okay, I got it.

MR. YODER: It doesn't need to be pool-wide degradation.

MEMBER BROWN: Yes, I got it.

MR. YODER: It could just be a localized

effect.

MEMBER BROWN: Gotcha. Thank you.

MR. YODER: Okay. So, now that we've talked about criticality a little bit, we'll talk about the specific materials that are in the pools and I'll try to quickly highlight some of the degradation mechanisms that we've seen.

On the screen now starting in the upper left, this is the Boraflex material. This is the bad actor that's out there.

And what you see in this picture is – the light gray area is what's called a "scallop" where the materials actually washed out all the boron carbides contained in the black area. And that gray area there is -- there's no material left anymore. And we'll talk specifics about each of the materials in future slides.

MEMBER CORRADINI: So, just to make sure, so, the stuff washes out, stays in the pool and just settles as a precipitate?

MR. YODER: The boron carbide settles out in the bottom of the pool and the silica – and we'll talk about this in –

MEMBER CORRADINI: Okay. Okay.

MR. YODER: -- a few slides – dissolves

into the pool.

MEMBER CORRADINI: Okay.

MR. YODER: The next picture is Carborundum. We've also seen significant degradation of this material.

Bottom left, this is Boral material. This is the most prevalent in spent fuel pools in the US today. You can see on this picture there's some blistering, and we'll talk more about that.

The last picture is a mixed metal composite where the boron carbide is actually an integral part with the aluminum matrix.

MEMBER BLEY: Didn't see any degradation there.

MR. YODER: That's the newest material. We've not seen degradation other than surface corrosion or –

MEMBER BLEY: That's the longest service time that –

MR. YODER: I'm sorry?

MEMBER BLEY: You said it's the newest material.

MR. YODER: This is the newest material. The shortest service time in the pool. I believe about a decade now.

MEMBER BLEY: Okay, it's ten years. We've seen it about ten years.

MEMBER BROWN: Is the MMC material clad, or is it just –

MR. YODER: No, it's just the aluminum with the boron carbide right on whether mixed with it –

MEMBER BROWN: Mixed in it, okay.

MEMBER CORRADINI: So, in terms of service lifes, approximately can you kind of give an idea to kind of follow up Dennis' question? I mean, which is the longest? Which is the –

MR. YODER: Carborundum and Boraflex have been in the pools the longest, I'd say.

MEMBER BLEY: But when do we first start seeing blisters?

MEMBER BALLINGER: That's in the boron.

MR. YODER: Boron material exhibits blisters.

MEMBER BLEY: Is it ten years of service? 20? 40?

MR. YODER: We'll discuss – I've got a slide on boron.

MEMBER BLEY: Okay.

MEMBER REMPE: So, Matt, I read the RACKLIFE code report and it claimed Boral had been in the pool before Boraflex and Carborundum.

Do you know for sure on that?

MR. YODER: No, I don't. I don't know for sure. I mean, we know – I don’t as personally talking to you today.

MEMBER REMPE: Yes.

MR. YODER: All of the Boraflex, Carborundum and Boral have been in the pool a long time.

MEMBER REMPE: Okay.

MR. YODER: Okay?

MEMBER REMPE: Yes.

MR. YODER: Whether one was in five years before the other, I mean, would the peanut gallery like to chime in?

MEMBER REMPE: I think Boraflex and Carborundum came in because they were trying to save because of the metal.

MR. CUMMINGS: I can try to address that. Boraflex was used – I’ll let the NRC –

MS. WONG: Okay. This is Emma Wong. I'm from staff.

Yes, Boral actually was inserted in the pools first. And then came along Boraflex and Carborundum that marketed themselves as cheaper and better solutions. Limited testing, of course. Then they installed those. Some still install Boral.

Once the degradation came online, then they started putting Boral back in more prevalently. And then now, we're to the MMCs.

MR. JACKSON: And the other thing that's worth noting is that each of these, there's different manufacturing processes.

It's all similar-type material, but how you make it and, you know, depending on what company makes it, there are differences in how it's fabricated.

And then once it gets to the pool, you know, the conditions that it sees in the pool are different as well and that would impact. The temperature, the flow, the radiation also impact the degradation.

MR. YODER: There is another point worth making while we're talking about the age of the materials. And that is that as Emma said, there's very old Boral, then there's newer Boral and we see different affects with the different materials, the manufacturing process and the materials that went into it. We'll talk a little bit more about that.

Okay. So, phenolic resins. This is your

Carborundum material. You've got the B4C encased in a phenolic resin.

Obviously, when you irradiate that, the backbone breaks down and you start to release the boron carbide material into the pool.

There's not a good predictive tool to determine how rapidly this stuff is degrading. When we talk about Boraflex, we'll explain a little further, but there is a predictive pool for that.

So, this is a similar material, but the boron carbide is encased in a silicone matrix. So, when this backbone breaks down, you get silicone particles that are dissolving into the pool.

And by monitoring the chemistry of the water in the pool, you can predict the rate of degradation of this material to determine how much B4C you've got left in your panels. And we'll talk more about that predictive tool, it's called RACKLIFE, on a future slide.

MEMBER CORRADINI: So, this is not an irradiation issue. This is just a sitting in a solution issue.

MR. YODER: It is irradiation. It's a combination of irradiation, as well as exposure to the pool environment –

MEMBER CORRADINI: Okay.

MR. YODER: -- and flow across the material.

MEMBER CORRADINI: Okay. All right. Thank you.

MR. YODER: So, this is Boral. Boral is clad with aluminum. The middle is an aluminum and boron carbide powder cermet.

In the older material, the Boral panel goes into a sheathing, stainless sheathing, and that sheathing was sealed on all sides. And they found that this thing would off gas when it was first put in and it was putting these large bulges in the stainless sheathing and that would bind fuel assemblies in place. So, they started to vent that sheathing material to alleviate that problem.

On newer Boral or on Boral panels that have gone in and been drilled subsequent to installation, you don't see the large bulging of the sheathing, but you still have blistering of the cladding material in the Boral itself.

As I alluded to, there's different vintages of this material. It's been in the pool for different periods of time, seen different service lifes, different pool chemistry, and you see a large variance in the presence of blisters, the severity of blisters, the size of the blisters and the location of the blisters whether they're in the center of a panel or coupon or on the perimeter, on the edge of a panel or coupon.

And that's one of the reasons that the staff feels that plant-specific surveillance of this material should be in place just because there is such a variance in pool environments and in the material itself.

So, the last two bullets on this slide, there has been some testing, in situ testing of Boral material that showed a relative decrease in its ability to attenuate neutrons, okay.

The belief is that that is not due to the Boron carbide material leaving. Rather, it's due to formation of one of these blisters that is displacing moderator and, therefore, impact your criticality analysis, or what has been more likely and more postulated by the industry is that it's a result of inaccuracies or uncertainties in the surveillance equipment itself.

So, those blisters that we talked about, the staff feels that those are potentially contributing to impacting criticality analysis, but at this point we don't believe that the actual Boron carbide material is leaving the panel itself.

So, for plants that don't have coupons in place to go in and perform surveillance where you can yank a coupon and send it to a lab and get a detailed test report on the neutron attenuation capability of that material, you've got to perform an in situ test.

And the tool that's commonly used by industry is the BADGER tool. It's the Boron Areal Density Gauge for Evaluating Racks. And this was developed for evaluating Boraflex material in conjunction with the RACKLIFE predictive code that I discussed earlier.

And the idea is that by measuring your silica levels, you can determine how degraded your panels are in certain regions and you can focus your inspections, your in situ inspections on those areas.

For the other materials like the Carborundum, we said is not a good predictive tool. So, you're taking a random sampling of 30 to 60 locations out of three or 4,000 panels in the pool.

Now, I'll talk more specifically about some of the uncertainties with the tool itself. The intent here was just to show you that statistically taking a small sample of a large population when you go in and perform these in situ tests.

MEMBER BALLINGER: Can you clarify for the rest of the Committee that – you said you've got a view of uncertainties.

MR. YODER: I will talk about some of the uncertainties associated with the BADGER pool itself.

MEMBER BALLINGER: The uncertainties are extremely large when you combine both the BADGER and the RACKLIFE system. Very large.

MEMBER BLEY: Well, when you go in and look at these things, do you tend to find kind of uniform degradation, or is it one spot here is really degraded and the rest of it looks pretty good?

MR. YODER: For the Boraflex material, it tends to be the panels that have seen the highest gamma dose.

MEMBER BLEY: Okay. So, that helps you focus whether you –

MR. YODER: Right. And also within a panel like we showed the scalloping, there will be localized effects and there will be actual gaps formed in the panel where the material will shrink and you'll actually have no neutrons or material.

One of the concerns is that if you were to have that scenario where you have large gaps on a number of adjacent panels, then you could have a localized criticality effect.

MEMBER SCHULTZ: Matt, could you describe in a little more detail what BADGER is doing? I didn’t see it particularly in your slides and –

MR. YODER: Sure.

MEMBER SCHULTZ: -- all of the Committee was not here at the subcommittee.

MR. YODER: Understood. So, what is physically going on is you are sending a source on one side of a panel in a spent fuel pool rack, and a detector on the other side of the panel, and you are measuring how much of that – how many of those neutrons are being attenuated by the neutron-absorber and the moderator in between your source and your detector. You're running a scan up the full length of the panel.

MEMBER CORRADINI: So, they have to move the fuel assembly, do the measurement, put the fuel assembly back.

MR. YODER: That's right. And that's one of the reasons why you're only testing 30 to 60 panels in a campaign, because it's labor intensive to move all of the fuel out of the area to perform tests.

MEMBER SCHULTZ: And the reason it would

not work for other neutron absorbers?

MR. YODER: It does. It was developed for Boraflex.

MEMBER SCHULTZ: Oh, I'm sorry. It says no predictive method exists.

MR. YODER: That's right. So, you're essentially, you know, you still try to focus your inspections on the highest dose areas or the highest temperature areas that normally coincide, but there's no break of software like the RACKLIFE to point you where to go.

It is used, the BADGER tool is used for other neutron-absorbing materials. It's used for the Carborundum and used for the Boral material for licensees who don't have coupons in place.

But the ideal scenario is a licensee put in enough coupons and put them in areas that are representative of what the actual panels are seeing and that you can pull those out without having to go in and move fuel around and test in situ, but many licensees don't have a sufficient number of coupons left in their pool to do that.

The newer materials, the X metal composites, all have substantial number of coupons in the pool such that they can pull coupons for the next

80 to a hundred years and not have to go in and do an in situ test.

I will pass it back over to Mr. Krepel for a few slides.

MR. KREPEL: Before we go on, are there any questions related to the materials for Matt?

MEMBER CORRADINI: So, just to summarize by what you said and one of the staff back here, Boral is probably the most prevalent at this point because of the other two being used and now not as – not behaving as promised so that you've got Boral in a majority of the current cases?

MR. YODER: Boral is the most – the more prevalent material in the pool today. And I think when Mr. Cummings from NEI presents, he has a couple pie charts that show –

MEMBER CORRADINI: Okay.

MR. YODER: -- the relative amounts of each of the materials.

MEMBER CORRADINI: And is it the staff's view that this BADGER – I like the name – that this BADGER method is good, but just too time-intensive to be used on an ongoing basis? Is that what –

MR. YODER: We might as well get into this at this point rather than wait until later. We had our Office of Research provide some support on this area and they provided several technical letter reports and I believe we provided this to the Subcommittee.

I don't know what level the full committee received those documents, but one of the areas that we looked at was this specific BADGER tool and trying to determine some of the uncertainties associated with it.

One of the big problems is that you have --

MEMBER CORRADINI: If you're going to get into it later, we can –

MR. YODER: No, we might as well hit it now, because we've really chopped these slides down to try to shorten the presentation.

CHAIRMAN STETKAR: We had quite a bit of discussion on these issues during the Subcommittee. So, we're fine for time.

MR. YODER: If you have the head that goes, the source or the detector head misaligned when you're running them down the panel, you're going to get an off result.

If you perform your calibration, let's say you're going in to test Boral material and you perform your calibration on a reference panel that is of a higher areal density than your actual material in the pool or a lower areal density in your current pool, you're introducing uncertainty.

There's a large number of uncertainties associated with this tool. Probably too many to get into in detail at this meeting today, but that is one of the – the licensees who utilize this surveillance methodology, we have a large number of questions in the appendix of the generic letter specifically trying to address those uncertainties.

So, we can go through them if you'd like, or that’s the reference to look at in –

MEMBER CORRADINI: No, that's fine. I haven't done my homework. So, I should go back to my homework.

So, let me ask a final – so, is there at least an estimate of what that uncertainty is under normal operational procedures?

You know, are we talking plus or minus 10 percent? Plus or minus 15 percent? Plus or minus a hundred percent? What are we talking about?

MEMBER BALLINGER: It's not a hundred.

MEMBER REMPE: Matt, we pushed you at the Subcommittee meeting on this question. You mentioned

30 percent.

MR. YODER: I mean, we're hesitant to put a number on it because the work that our Office of Research did was really without having, you know, physical test data to really look at.

But when staff from NRR went on a campaign to observe, we were seeing around 30 percent –

MEMBER CORRADINI: Okay, fine.

MR. YODER: -- difference from the nominal –

MEMBER CORRADINI: So, that's anecdotal.

MR. YODER: That is one specific pool, and one specific test campaign, yes.

MEMBER CORRADINI: Okay.

MR. YODER: That is not inconsistent with the relative numbers that were in that generic BADGER technical letter report.

MEMBER CORRADINI: Okay, thank you.

MEMBER BALLINGER: But the key difference is not when you use this for Boral. It's when you use it for Boraflex and Carborundum, what the uncertainty means for the kind of degradation that you see in the – or can see in the older stuff, the stuff that does degrade.

MEMBER RICCARDELLA: But I recall from the

Subcommittee meeting there's a BADGER 2 or Super BADGER that they're coming out with now.

MR. YODER: They are attempting to make modifications to the original BADGER tool and what has been termed the Super BADGER tool is – has actually been used on several campaigns now to attempt to reduce those uncertainties, yes.

MEMBER SCHULTZ: So, Matt, there's two pieces here that you mentioned. One of course is the BADGER measurement, and the other is RACKLIFE uses to inform to identify the area of the pool that might be the best to evaluate or the worst, if you will, to examine, but then RACKLIFE is given the number of panels that you can explore, there's quite an extrapolation to the rest of the pool and what do we know about the capability of RACKLIFE to do that.

You mentioned that the input has to do with some measurements associated with what is found related to the silica in the pool.

MR. YODER: Right.

MEMBER RICCARDELLA: That doesn't sound like a very distinct input parameter that would tell you what's happening in the rest of the pool, necessarily.

MR. YODER: Correct. We also had a

technical letter report created by our Office of Research on the RACKLIFE pool. And the bottom line for the purposes of this full committee meeting are that that tool was never designed to get to these levels of 40, 50, 60 percent degradation. It becomes much less accurate when you've degraded your material to that point.

It was meant to be a course tool when plants were starting to see 10, 15, 20 percent degradation to make sure you didn't have a large step increase between outages or you saw all of a sudden a lot of silica.

Now that we've hit this point, as I said, there's a whole technical letter report describing the uncertainties associated with this, but, yes, the bottom line is if you have Boraflex in your pool, you're in a bad place and you need to be working towards a physical remedy, not relying on these tools that were developed 15 or 20 years ago to manage this material.

MEMBER RICCARDELLA: If you're counting on the Boraflex. I thought most of the plants with Boraflex weren’t counting it in their criticality –

MR. YODER: So, we still have, I believe, around ten plants that credit Boraflex, okay. So, as you'll hear a little bit later from NEI, many of those licensees have moved towards making the critical modifications to their pool or to just doing away with credit.

And in order to do that, you've got to have enough space in your pool to space the assemblies out and create empty channels.

MEMBER CORRADINI: Or soluble Boron, or is that not an option?

MR. YODER: Some plants have credit for soluble Boron and they're out of space.

MEMBER CORRADINI: Okay.

MR. JACKSON: You got to remember that there is a twofold requirement. One is that you be sure that you're subcritical without crediting the Boron, the soluble boron. So, the 50.68 –

MEMBER CORRADINI: And with soluble boron – or with any sort of mitigation you’re below 0.95.

MR. JACKSON: The soluble boron below 0.95, that's correct.

MEMBER CORRADINI: Soluble boron, or soluble boron or boraflex or something?

MR. JACKSON: No, soluble boron.

MEMBER CORRADINI: Oh, okay. And the Boraflex and all this stuff just as margin? That's why I'm trying to figure out why you even use it if – if I've shown on below 0.95 with the soluble boron, I'm showing without the soluble boron that below one, why would I expend the money to put any of this in?

MEMBER BALLINGER: A BWR can't use soluble boron.

MR. JACKSON: The BWR don't have soluble boron in the pool.

MEMBER CORRADINI: Oh.

MR. JACKSON: And then the second one is BWRs require the neutron-absorbing material to stay below the one for the un-borated case.

MR. CUMMINGS: My short answer is that the neutron absorber is credited in the analysis.

MEMBER CORRADINI: Okay. Thank you.

MR. JACKSON: So, you can see this becomes a challenge when a license amendment request comes in that credits the BADGER uncertainties and we have to then include those uncertainties in the K effective calculation which requires a confidence interval.

MR. YODER: Are we ready to move on?

MR. KREPEL: Okay. Now, we'd like to discuss some of the operating experiences that the NRC staff have observed and actually the staff trying to take action to address these issues that are identified.

For example, in the generic letter there are also other references. There's INS, information notices, that give explanation and detail. Information notices that give specific transient events especially with plants that has been – that if it had been issued information notices in order to make notice to all the licensees that the plants they maybe need to kind of look into applying the systems to the facilities.

In the Subcommittee meeting, Dr. Rempe had requested – I'm sorry. The interpreter mispronounced your name.

MEMBER REMPE: No, he's alright.

(Laughter.)

(Comments off record.)

MR. KREPEL: Okay. You had requested information about some other operating events and how that the -- prevalent that the issues were in the industry.

The NRC staff have identified some issues related to that and some other regulatory procedures have been identified the licensing amendment requests that have been gone through, some additional licensee commitments and also some enforcement activities and processes that may be prevalent to use under 10 CFR 50.59. Non-cited violations.

Also, in some situations, some issues were identified by the licensee or by inspectors that were placed into the corrective action program for resolution at a later time.

One of the key points to be made is that Dr. Rempe challenged the NRC staff to identify how much margin that was available before and after these limits were in place.

All that we have identified or we tend to be identified issues have been resolved before the NRC staff really had enough information to make that determination for the reactivity margin. So, we really can't answer that question, per se.

MEMBER REMPE: I appreciated the information you did provide. It helped me understand how many events had occurred.

MR. KREPEL: Excellent. Okay. So, I'm happy to help.

Okay, Matt. Did you want to proceed?

Before the NRC took action to include with this issuing the generic letter 96-04, sets this expectation that the requesting evaluation of the Boraflex degradation. So, it would be monitored to see whether or not the degradation was approaching the point where it became an issue.

Unfortunately, some of our recent operating experiences suggest that some monitoring activity program results in the generic letter haven't been as effective in making sure the goals are met.

And Matt's discussed the Research Office and the technical evaluations. And some of the neutron-absorbing material in the program – observing that in the programs and have identified some uncertainties that may not be addressed by the licensee.

With that information, the NRC has developed through research and evaluation, we've also included – incorporated that today is in guidance to show – to help the updated – to help update the GALL report for the aging management and covering specific monitoring programs appropriate to monitor Boraflex and the unbound Boraflex material.

So, the staff has taken lead in the criticality analyses and included statements to include how the degradation or the uncertainties of possible degradation will affect the criticality analysis. So, that would be appropriate for the application.

CHAIRMAN STETKAR: Scott, you mentioned the update to the guidance in the GALL report. I'm assuming that's GALL Rev 2 includes this?

MR. KREPEL: Yes.

CHAIRMAN STETKAR: The GALL is for plants that have had their – already had their licenses renewed or plants that are in the renewal process now who are committed to the aging management programs in GALL Rev 2.

Does staff consider that an appropriate aging management program that nothing else would be needed?

MR. KREPEL: In general, yes.

CHAIRMAN STETKAR: Okay. How does the staff determination – because a large number of the units that have had their licenses renewed committed only to GALL Rev 1.

Are there substantial differences in the aging management guidance in GALL Rev 2 in this area that the plants that have only committed to GALL Rev 1 do not meet?

If you understand the question, because what I'm trying to get a handle on is I think we now have something like 75 – I think it's 73 units that have been approved for a license renewal.

I think the majority of those, and I don't have the count, have committed to GALL Rev 1. Some of them have committed to GALL Rev 2. I'm trying to get a handle where we are in a current snapshot.

Maybe the industry has these statistics, but I'm trying to get a current idea of where we are in terms of plants that have already had their licenses renewed that would essentially meet the staff's guidance.

MEMBER RICCARDELLA: What's the significance of Rev 1 versus Rev 2 on this?

CHAIRMAN STETKAR: Well, that's what I'm asking Scott. I'm not familiar with the change. I'm familiar with the changes between Rev 1 and Rev 2 in some other areas like cables and buried piping. I'm not familiar with the changes in the area of monitoring spent fuel pools. That's basically what I'm asking.

MR. YODER: I'll address the specific changes between Rev 1 and Rev 2. Okay. Rev 1 there was an aging management program for Boraflex.

CHAIRMAN STETKAR: Only Boraflex.

MR. YODER: Correct.

CHAIRMAN STETKAR: Okay.

MR. YODER: In Rev 2, we added in an aging management program for neutron-absorbing materials other than Boraflex.

CHAIRMAN STETKAR: Okay. So, plants that, if I understand it then, plants that have Boraflex and have had their licenses extended and committed to GALL Rev 1 are okay in terms of their monitoring program?

MR. YODER: They have a program in place that relies on these tools that we've described that has significant uncertainty. And that's one of the aspects that we’d like to –

CHAIRMAN STETKAR: Okay.

MR. YODER: -- obtain with the generic letter is have you accounted for that uncertainty in your specific pool.

So, yes, they've got programs in place for GALL Rev 1 aging management program.

CHAIRMAN STETKAR: And for their renewed license.

MR. YODER: Correct. At the time that they renewed their license, a lot of these, you know, it was a given that, you know, these tools that were in place, the predictive tools and the in situ measurement tools were accurate and they were telling you exactly where you needed to be.

Since then, we're not so sure. So, those are areas that will need to be revisited with those, that subset of plants.

CHAIRMAN STETKAR: Okay, that helps. I had either forgotten or didn't know that GALL Rev 1 only addressed Boraflex specifically.

MEMBER BALLINGER: So, the gap, if there is one, is between Boraflex and Boral.

CHAIRMAN STETKAR: Well, Boraflex and Boral and now the staff is saying additionally even with Boraflex they are not – if I'm understanding what you're saying, Matt, that the staff now has raised additional concerns about whether the tools that the licensees now, the extended licensees are crediting are adequate; is that –

MR. YODER: Because of uncertainty.

MEMBER BALLINGER: In spite of the fact that they comply with Rev 1.

CHAIRMAN STETKAR: In spite of the fact that they have a license, well, an approved license extension based on an aging management program that complies with Rev 1 using the tools that they –

MR. YODER: That's correct. The other subset of plants that comes into play here is the Carborundum plants.

CHAIRMAN STETKAR: Yeah, but anything non-

Boraflex obviously is the –

MR. YODER: Right. So, there you –

CHAIRMAN STETKAR: -- gap between 1 and 2.

MR. YODER: There you've got a concern because you have a material that we've seen active degradation in. And anyone who renewed their license by Rev 2 may not have a program in place.

CHAIRMAN STETKAR: I understand that. Thanks.

MR. CUMMINGS: I'm sorry, but I don't think that's an accurate assessment.

CHAIRMAN STETKAR: Okay.

MR. CUMMINGS: I have to jump in. If they had monitoring programs before they went through license renewal, they would have continued to maintain them. So, sorry.

CHAIRMAN STETKAR: I'm just trying to get a sense of a regulatory footprint in the sense of –

MR. CUMMINGS: I understand.

CHAIRMAN STETKAR: -- where we are, you know, in terms of inventory of plants.

MR. CUMMINGS: Right.

CHAIRMAN STETKAR: You can certainly address that when you come up.

MR. CUMMINGS: I will.

MEMBER REMPE: I have a question about the plants that have been licensed under 10 CFR 52. Your generic letter exempts those plants because you have enough information, is what I'm reading here, right? The draft that I have of your generic letter says that they do not have to respond to this because you have enough information from them.

MR. KREPEL: If I could answer that question, I can tell you that in the past few years the NRC staff have been asking a lot of those kind of questions we've been asking in the generic letter and we've also included that in our generic letter that if the plant has been approved with the license appendix that has all its information that we've been asking for in the generic letter, if that's okay for them to reference that in the license amendment request.

And all that information that they would need would be in there already. That's already included in the generic letter. That's one option to respond with.

CHAIRMAN STETKAR: But Joy's asking about new licensees, COLAs under either design certifications or COLAs under 52.

MEMBER REMPE: Yeah, it says that Vogtle, basically, and Summer are exempted. But the reason

I'm asking this question is; one, to confirm that. And then; two, I mean, I assume they're using one of the newer materials because they're a new plant, but you aren't so sure about these new materials.

And so, why is it you have decided to exempt them? Have they committed to so many coupons or what is it that they do that makes you feel that they don't have to do anything?

MR. JACKSON: Well, the term – that’s a good question and we went and talked to Office of New Reactors to see if we should include them in the generic letter request and so forth.

So, there's a couple things that apply. First, when we licensed the, you know, under Part 52 the design certifications, just the design and the programmatic requirements come into the COL, these issues were in play.

Matter of fact, the, you know, we talked about the generic letter and the generic letter 96-04 had already been issued. So, when we talked to them, they felt that they were already covered, that those issues were addressed in the license and just didn't need to be – we didn’t need to revisit.

So, I mean, the first thing is the degradation obviously hasn't occurred, but then secondly is that that was informed or they were aware of these issues and addressed them up front.

MEMBER REMPE: How did they address them?

MR. JACKSON: That, I don't know. I didn't bring that New Reactor person here.

MEMBER REMPE: Okay, thank you. I'm sorry.

MS. WONG: This is Emma Wong from staff again. Actually, they haven't submitted what their spent fuel pool plan will look like, what the racks are going to look like. They're starting to submit those now.

And they also – the staff of NRO when they approve like the COLs, they put in a condition saying that you must submit what you're going to do for the future.

So, if we were to ask them, they would say we have nothing.

MEMBER REMPE: So, it's sort of like an ITAAC that they'll have to deal with.

MS. WONG: Yes, they have to do it. They have to submit something to the staff and then it will get approved by the staff.

MEMBER REMPE: Okay.

MS. WONG: So, there's already a plan in

place for those new reactors and there's no reason to ask them for something that they haven't planned for yet.

MEMBER REMPE: Okay, thanks for clarifying.

MR. CUMMINGS: Can I provide a clarification on that? They do have a design for the AP-1000 plants. When I was at Holtec, I did the criticality analysis for it. They have a monitoring program.

I then went to Westinghouse and there was some review by NRO for that. There was some back and forth.

So, there is a design of the racks that, to my knowledge, that's what's expected to be put into the pools. So, I guess I disagree that there is nothing on the Part 52 side.

The racks have been designed and analyzed and there is a monitoring program, to my knowledge.

MEMBER BALLINGER: I need to butt in here. For time purposes, we have discriminated against the industry by giving the staff an hour and them 15 minutes, and we need to be sure that we have adequate time. So, I'd like to finish up as quickly as we can here so that we've got enough time.

MR. JACKSON: We'll have to collect an action item and get back to you, but when you say "exempted," they're not exempted from the requirements. They're exempted from the information collection.

So, in our discussions with new reactors, we felt that we weren't going to get anything. So, you know, it's been several years since I was in New Reactors. But at the time, there was -

MEMBER REMPE: I understand the situation, okay.

MR. KREPEL: So, are there any more slides? We can move on this with more slides, Matt.

So, we've collected all of the technical information and also the Research Office has developed a database in order to really find out what we know about each licensee and how they're meeting the requirements of what the neutron-absorbing materials are doing.

The references, the documentation, the licensing documentation that we have available and it asks the question about how – Dr. Rempe asked the question about how – what kind of – what list of pool meets subcriticality requirements and they're listed here with the Carborundum and Tetrabor that's in four spent fuel pools. Boraflex is between 10 to 14 spent fuel pools. Boral is in 53. And other materials which also include borated stainless steel, Bolcan, Metamic, some newer ones, there are about about 13 to 16 spent fuel pools.

Now, the reason why we have that average, this is the information here, we have several licensees that just recently have license amendments approved that have removed the Boraflex credits. And some have replaced that with wrong inserts. Made them – made of Metamic.

And so, those license approvals – those license events have been approved by -- have been implemented in full so that as soon as possible they can continue the credits for the Boraflex or be already set up and implemented as a license amendment without having to go through that in which case there's no longer credit for the Boraflex be given. It would be credited for something else instead. So, there's a reason for that average and why those numbers are a range there.

Okay. So, that's really all that I have for today, but all this information for the operating experiences and the NRC staff activities, we have been learning and finding that we have some gaps, major gaps in our knowledge that has – it makes it difficult for us to really give answers to specific questions that you may have.

So, that's the reason why the staff has decided to issue this generic letter in order to gather information that we actually need.

To describe the generic letter more in detail, we will turn to Matt now.

MR. YODER: All right. I should be able to wrap up the staff's presentation fairly quickly here.

The purpose of the generic letter is to request information that demonstrates that licensees are within their licensing and design basis for the neutron-absorbing material.

Based on the responses to that generic letter, we will determine if additional regulatory action is necessary.

I would like to talk quickly about the specific information that we request in the generic letter. And for the Subcommittee, we provided multiple slides on each of these topical areas.

So, if anyone would like to dub into any, I'd be glad to do that, but I'll just for the purpose of getting us back on time, I'll go through this quickly.

First major area is the material properties and configurations. What is the actual material type? What is the age of the material? What is the as-built areal density? What is the current areal density? Those type of things.

Second area is your surveillance program methodology. What are you doing? Do you have coupons in place? Are you performing the in situ test with the BADGER tool? Are you just performing visual surveillance? What kind of sample size are you taking when you do perform surveillance? What are your acceptance criteria? How are you trending the data? That type of information.

Third area is the surveillance program frequency. How often are you going in and performing surveillance of the material?

It should be acknowledged that this can be performance-based based on your specific material. For the new materials, the materials that we haven't seen degradation, we've got a larger interval between surveillances. The materials that are actively degrading, we specify that there should be a shorter surveillance interval.

How is your material condition being

accounted for in your criticality analysis? Are you feeding that degradation back into your criticality analysis? How are you trending that? How are you accounting for it?

And in the final area that we requested is, have you considered design basis events? Have you considered a seismic event on your pool?

So, if you have this riddled material that has been irradiated and now scalloped and cracking apart, what confidence do you have it's going to survive a seismic event?

One slide quickly addressing the staff's response to some of the public comments we received. And we just touched on two big areas here.

The first is that licensees had margin built into their analysis. And that margin was used to account for various uncertainties.

What we don't want is licensees coming in now that we've identified new uncertainties and using that same margin to address those uncertainties.

In other words, we don't want to have a double counting of margin to address the new uncertainties that we discovered.

MEMBER CORRADINI: Can I make sure I understand?

MR. YODER: Yes.

MEMBER CORRADINI: So, another way of saying that is in your mind, uncertainties have grown. And so, margin must – might have increase? That's another way of saying it. Am I misunderstanding you?

MR. JACKSON: This is Chris Jackson again. Emma is going to correct me if I'm wrong or Scott, but when the license was issued when the analyses were done, they analyzed certain things and they disregarded things as being – there were conservatives built in into the analysis and they were used to offset other things, other unknowns, you know.

So, like if you credit burn-up or depletion or the, you know, there are uncertainties in there and they are considered.

So, when we identify new mechanisms ten years later, going in and picking some of those non-conservatisms or conservatisms and say I'm going to offset these new non-conservatisms with them, that's dangerous because we don't want to double count.

So, I guess what he's saying is double counting conservatisms isn't appropriate. It's not something that we should do.

Additionally, some of the margin – quite a bit of the margin that we have in the pool is required by regulation, you know.

We have a regulatory construct. There's – this is a pool without a containment, without control rods, without monitoring. There's no defense-in-depth or last defense-in-depth in this industry. So, you know, many of the requirements are required by regulations.

MEMBER CORRADINI: So, can I say it back another way just to make sure I'm clear? So, your point would be that – so, let me push it in a provocative way.

So, if the licensee has a better way to analyze things that they took conservative calculations for in the past although they might be able to show it, you may not consider it?

In other words, if I'm computing something, the effective burn-up, and somehow my uncertainty was ten percent then, but I can show it by calculation as five percent now, I can't take that and apply it somewhere else, is what you're telling me.

MR. JACKSON: No, no. What I'm saying is we'll always consider it. We'll give them any conservatism, any credit that they have, you know, we'll entertain anything if they can justify it.

MEMBER CORRADINI: Okay.

MR. JACKSON: Okay. But numerous public comments came in – or several public comments came in saying, don't issue the generic letter, because there's inherent margin in here and there's no issues –

MEMBER CORRADINI: And your point is unless you can show it –

MR. JACKSON: Yes.

MEMBER CORRADINI: -- by calculation, technical – and technically justify it, you just can't –

MR. JACKSON: By calculation or any –

MEMBER CORRADINI: Okay. Okay.

MR. JACKSON: But we have a requirement that requires substantial margin and –

MEMBER CORRADINI: Okay, thank you.

MEMBER SCHULTZ: And it ought to have been reviewed and approved in a submittal if –

MEMBER CORRADINI: Sure.

MEMBER SCHULTZ: -- the margin has been changed because of new calculational techniques, for example, that would have been an issue that required a license amendment request and approval by the staff.

MEMBER CORRADINI: Okay, thank you.

MR. JACKSON: So, if somebody comes in

with a license amendment request and says, I don't know the power distribution or the power shape on all these assemblies, I'm going to use a conservative one, okay, that is a conscious decision there.

Now, crediting that conservatism in another area is very difficult or very dangerous, because I don't know how much it is. So, if it is an unknown, bounded by a conservatism and there's several of these areas that, you know, I changed T-HOD or you got a power uprate somewhere in the middle, you know, somewhere during plant life. I'm going to use the hotter T-HOD calculating burnoff.

That's not a conservatism in the sense that many of the assemblies in that pool will have been burned at the limit rather than many of them were not.

So, conservative decisions were made in the criticality analysis. And, you know, when you've got 4,000 spaces in the pool, you're going to make assumptions, but –

MEMBER CORRADINI: I'm with you now. I'm with you. Thank you very much.

MR. YODER: The other point I'd like to make here, there was a margin of our comments that stated, you know, we haven't seen degradation of our material. Why do we have to go in and perform a surveillance?

And the staff's point on that is, you know, we hadn't seen degradation of Carborundum material until somebody actually went in and looked and found that it was 60 percent degraded from its original condition.

We don't want to end up in that situation with any of the other materials. We haven't seen what we believe to be significant degradation with the boron material or the Metamic or the other mixed metal composite materials, but we feel that a surveillance program should be in place on a pretty specific basis so that should degradation occur, it will be identified and mitigated.

So, to sum up the staff's presentation, we feel this is a compliance and a safety issue we feel that needs to be managed appropriately.

Recent events have raised concerns that the monitoring programs may not be adequate and that's, you know, the situations where I described people hadn't looked, and then all of a sudden you look and you have problems, but I also described situations where people were relying on the predictive tools and thought they were okay. And then when they went in and performed the in situ test, they realized that because of the uncertainties associated with both the predictive tool and the in situ measurement, they weren't okay.

Final point here is that the staff feels that this is all information that a licensee should have readily available. We don't feel that we're asking for any new analysis or new research by licensees to answer this generic letter.

I'll take questions for the staff and then we'll pass it over to NEI for their presentation.

MEMBER BALLINGER: Any questions from the Committee?

(No response.)

MEMBER BALLINGER: Alright, the floor is yours.

MR. CUMMINGS: Great. Thank you very much. My name is Kristopher Cummings. I'm a senior project manager for used fuel programs at NEI.

My background is I had ten years at Holtec, a rack manufacturer. And then four years at Westinghouse. So, I'm very familiar with all these issues. This is basically one of the areas that I focused on in my career.

Next slide. So, these are the topics that

I'll cover. I won't go through these, because we'll get to them and I'm short on time.

Next slide. I'm not going to reiterate. I think Matt did a really good job of describing the materials.

I did bring the samples again. So, I think it's very illustrative to see the differences. I'll pass them around again for those committee members that weren't at the subcommittee.

The one that flops around and is obviously a polymer is Boraflex. This is non-irradiated for steam Boraflex. So, understand that. Please be careful with it. I'd like it back in the state that I've provide it.

MEMBER CORRADINI: I guess it gets a tad more fragile as you –

MR. CUMMINGS: It does get more fragile. It irradiates. It becomes brittle. It becomes a hard material. And then as you actually look at it, it almost becomes a powder.

So, the next one, the very small metallic sample is Boral. Here you can see the aluminum cladding on the sides if you look very closely at it.

And then the last one if Boralcan, but it's representative of all the metal-matrix whether it's Metamic, Boralcan or some of the other types. And again, you can see no aluminum cladding. And again, these are very nice, hard materials.

(Comments off record.)

SPEAKER: You say this does not have – it seems to have something on the –

MR. CUMMINGS: No, it does not have an aluminum cladding on it. It appears that way, but I does not.

MEMBER CORRADINI: So, that's the dispersion.

MR. CUMMINGS: Yes.

MEMBER CORRADINI: Don't look at it directly.

MR. CUMMINGS: Right. So, the metal-matrix are more of mixed powders put together. They're put into a billet and then they're extruded through a press. At least Metamic is. And then it's rolled to the appropriate thicknesses and sizes.

MEMBER RICCARDELLA: So, he rolling process produces the –

MR. CUMMINGS: Exactly. Exactly.

MR. YODER: And the shearing of the edges of the coupon also creates a little bit of that effect.

MR. CUMMINGS: Exactly. All right. The thing that I want to point out, of course, is that there are significant differences in the types of materials whether it's the nonmetallic versus the metallic.

And we see that evidenced by both the phenomenological effects that cause the degradation and also the service life. We talked about that a little bit earlier.

Next slide. So, here I've got a little bit of information about the types of neutron absorbers in use and the types of monitoring programs that have been in place.

For Carborundum and Tetrabor and Boraflex, it was their knowledge that they all had monitoring programs at some point. With Boraflex if it was coupons, then those coupons have disappeared. We've seen that degradation of the coupons. However, a lot of the plants have moved away from the credit.

And if you look at the graphs here, you can see on the top graph I've got the installed neutron absorber. So, you see Boraflex was a fairly large percentage.

Now, you go down to the bottom one, credited neutron absorber. A lot of the plants have moved away. Not quite all of them, and several of them have license amendment requests in to either install inserts or do new analysis to take away the credit, but that's continuing to go forward.

In terms of Boral, about 50 percent of the plants have a coupon testing program. Those that do not have coupon testing programs were actually because of two letters that I'm aware of that the NRC wrote to the industry.

The industry requested the NRC to take a position on surveillance programs associated with Boral. In both 1995 and 2003 the industry wrote back to the industry saying that surveillance programs are not required of Boral.

The specific wording was that it would be superfluous. That was in 2003 and I can provide those letters to the Committee if they'd like to see them.

MEMBER RICCARDELLA: Would you say the extent of the problem are those two green slices in the bottom chart?

MR. CUMMINGS: The extent of the issues where we see degradation, loss of material that would affect the criticality and have something more than cosmetic, would be limited to Carborundum, Tetrabor and Boraflex.

MEMBER RICCARDELLA: And how many plans are in those two slices?

MR. CUMMINGS: Carborundum would be four. The NRC had that. Our own survey, we had seven with Boraflex, but the ten to 14 is not out of the – that seems like –

MEMBER CORRADINI: As a total number.

MEMBER RICCARDELLA: As a total.

MR. CUMMINGS: As a total.

MEMBER RICCARDELLA: But seven that are taking – I'm looking at the difference between credited versus non-credited.

MR. CUMMINGS: So, in that bottom graph, Boraflex would be seven.

MEMBER RICCARDELLA: Seven.

MR. CUMMINGS: Right. Now, that was a year ago and I know of at least one of those whose gotten a license amendment request to no take credit for it anymore through inserts.

MEMBER REMPE: So, I'm sorry. I was distracted, but you're saying seven versus the staff saying 10 to 14.

MR. CUMMINGS: Yeah, but I don't think the 10 to 14 is unreasonable because our survey was not comprehensive.

MEMBER REMPE: Okay. So, this was with the 70 percent and –

MR. CUMMINGS: Yes.

MEMBER REMPE: -- the other insert, right.

MR. CUMMINGS: Yes, that's correct.

MEMBER REMPE: Okay.

MEMBER BALLINGER: But the trend is down.

MR. CUMMINGS: It is down. But like we discussed at the Subcommittee, it's not to zero. There is one plant that just got approval with partial credit for Boraflex.

Next slide. So, is this a safety issue? That's – I've answered this question several times. The way that I've set this up is differentiating between the metallic and the non-metallic absorbers.

For the non-metallic absorbers, we feel like that it has been largely addressed through new analysis, adding an Nc2 monitoring program, but obviously it's very important to have a robust monitoring program if you have the non-metallic absorbers in place.

For metallic absorbers, we know that the aging effects are very slow. Decades. We have 30 years of experience of Boral, if not more.

The EPRI database is 25 years and we would see advance indication through the various monitoring programs or pool chemistry observations.

The aging effects that we've seen on the metallic-based absorbers are relatively cosmetic whether it's pitting, general corrosion or some of the very small, localized loss of material that would have a negligible effect on criticality.

And finally the Boral blistering which could potentially displace moderator, that's really only an issue for Region I flux-trap racks that have a small water gap between the storage cells. For Region II where it's one sheet, it doesn't have a significant effect on reactivity.

But if you try to actually model it and you go in and model accuracy based on what you've seen, it has a relatively minor reactivity effect.

And all of those types of things when a plant's gone in and pulled the coupon, looked at it, seen blistering, they put that into their corrective action program.

They may go in and do some sort of analysis to show that it's not a compliance or a safety issue, but that's all been done within the corrective action and quality assurance program of the plants.

And now, the bottom box is applicable to all of the issues and all of the absorbers is that per the NRC's own presentation, you would need a large loss of material to overcome the administrative margin. And here, I'm talking about the 0.95 to 1.0.

You would need a 50 to 60 percent loss of material in all absorbers or a significant number of absorbers in one area of the pool. And then there are significant amounts of independent reactivity hold down in the pools for PWRS.

We've talked about the soluble boron. That's 20 percent in K for BWR pools. The analysis itself has significant conservatism. They take a maximum reactivity of each plane or of the worst plane in the fuel assembly. That's about 10 percent in reactivity. And then you do have the regulatory administrative margin there.

MEMBER REMPE: Kris, on your slide there it has aging effect. And it's under the metallic absorbers. And it has localized loss of material.

Are you aware of there ever being any localized loss of materials with something like Boral?

MR. CUMMINGS: Yes, in the terms of pitting. So, you may have like some small pitting. Now, you're talking about smaller than a – or about a millimeter in diameter, if that. So, very, very small and localized.

And there's been some very localized corrosion on the edges where maybe a small chunk of the material might have fallen out.

And, again, we're talking about smaller than a millimeter in diameter. So, very, very localized.

Much more localized than what we're talking about and what the NRC talked about in their presentation. A small pit or something like that, that's not going to have any impact on reactivity. And I'll get to what the industry is trying to do to address that. How much of that is acceptable.

Okay. Next slide. So, that feeds right into that. So, we have a couple different programs ongoing in the industry.

The first is an accelerated Boral corrosion testing program. It's basically a five-year program to look at how does Boral degrade? It's got several different types of Boral in terms of the manufacturing process. It's an accelerated corrosion test.

To be clear, it came up at the subcommittee meeting, it doesn't not have irradiation effects in it and it's not a flowing water type of test. So, those are some limitations of the test.

We're just – EPRI is just getting started on a project at Zion where they're going to pull the coupons, some in-service material. They'll actually cut the racks and pull some panels that are in the sheathing, out of the racks. And then do some BADGER testing to try to create a correlation between coupons, in-service material and BADGER results and look to see what is the comparison between those three techniques.

MEMBER RICCARDELLA: BADGER or Super BADGER?

MR. CUMMINGS: It will be Super BADGER. I'm sorry. That's correct.

(Laughter.)

MEMBER RICCARDELLA: When you say "accelerated," it's accelerated with the aggressive environment?

MR. CUMMINGS: It's accelerated in terms of temperature. So, it's 195 degrees Fahrenheit, correct. So, it's trying to simulate advanced corrosion through temperature.

MEMBER BALLINGER: My understanding is that of the uncertainty sources for the BADGER-RACKLIFE combination, if you will, one of them is temperature.

MR. CUMMINGS: I believe there is a component of temperature in that. Now, RACKLIFE isn't applicable here because we're talking about Boral, but correct.

MEMBER REMPE: Some of the emails after the subcommittee meeting, we discussed through staff members about the flow effects. And there were some reports or something that you were going to, I mean, I had the handbook already.

MR. CUMMINGS: Right.

MEMBER REMPE: But there were some backup reports talking about the flow effects and how much degradation was observed with it.

MR. CUMMINGS: I'm not sure that the flow effects were included in those backup reports. I'm having EPRI still work on getting those backup reports.

Now, flow is important in, say, for instance, Boral where you've now got the material come to – I don't want to – it's not a powder, but the silicon matrix that holds it together is –

SPEAKER: It's not Boral.

MR. CUMMINGS: Yes, Boraflex.

MEMBER REMPE: And how much effect it is on

Boral would be of interest to –

MR. CUMMINGS: I'm not sure that that exists, but I can certainly take that to –

MEMBER REMPE: Because the test doesn't consider flow.

MR. CUMMINGS: You're right. It doesn't. The one thing that I can say about flow with Boral is that some of the racks were designed with an observation hole in the sheathing.

So, a little hole in the sheathing so that you could say, hey, is my neutron absorber still there? Quick and simple.

And so, when they've gone in and looked at those or even an observation hole in the coupons, the sheathing encapsulating the coupons, you can see some evidence of flow going in through that observation hole and you can see that kind of a rainbow effect on the surface of the Boral.

So, there are some instance of that, but my response back to the question from the Subcommittee was because it's the actual materials encapsulated in the sheathing, that's going – you're not going to get a huge amount of significant flow through it. The major flow is going to be up through the storage cells and cells in the fuel assemblies.

Now, you might have some localized heating, gamma heating of the water and the sheathing. I don't know that we've gone to that level of detail to investigate it, but until you get – my opinion is – or thought is that until you get to a level of degradation where you might actually be having B4C particles come out, flow is probably not going to be a huge effect, but I don't know that I have any technical data to back that up.

MR. YODER: I don't think I would dispute the impact of low on Boral, but I would say that Boraflex is in sheathing, too, and flow is absolutely a dominant factor there.

MR. CUMMINGS: Right.

MR. YODER: So, the sheathing by itself doesn't preclude flow on Boral material.

MR. CUMMINGS: Correct. Right.

All right. And then finally we have NEI 12-16, which is a guidance document for performing criticality analysis.

We do have a section in there on inappropriate monitoring program, which we're looking for NRC endorsement on.

The industry shares information through the EPRI NAUG, the Neutron Absorber Users Group. And like I was talking about, we're now exploring with EPRI a possibility to do some sensitivity studies on what is the reactivity effect of pitting, holes, generalized corrosion, blistering?

And I'd like to do that not in terms of what have we seen operationally and what will the effect be, but how big of a pit, you know, would a one-inch pit, you know, be enough or a one-inch hole in the neutron absorber, you know, at a periodic basis be enough to cause a reactivity effect to try and quantify what is or isn't an issue in terms of blistering, pitting, corrosion, things like that.

MEMBER SCHULTZ: This is the bulk of NEI 12-16. Is that focused on the methodology? The criticality analysis methodology?

MR. CUMMINGS: It is. The bulk of it is based on –

MEMBER SCHULTZ: What degree has that been now adopted by industry?

MR. CUMMINGS: Well, it would not be adopted by industry until NRC endorses it. And that's the goal is to get NRC endorsement of that product.

Now, there have been some licensees who have used the non-endorsed version –

MEMBER SCHULTZ: Going forward.

MR. CUMMINGS: -- moving forward. But the idea with the endorsement of the NEI guidance document is that, in essence, we have a recipe to help reduce the regulatory uncertainty associated with submitting a criticality analysis and a methodology for doing that criticality analysis.

MEMBER RICCARDELLA: That's independent of the type of absorber material?

MR. CUMMINGS: That's independent of the type of absorber material, correct.

MEMBER SCHULTZ: And has that been submitted for review?

MR. CUMMINGS: Yes, it has. The Revision 1 was submitted in March of 2014.

MEMBER SCHULTZ: Okay.

MR. CUMMINGS: And that was after a series of four day-long meetings with the NRC to go through the technical aspects of what do you put into a criticality analysis and what is the methodology. And we started to get RAIs from the NRC on some of the underlying EPRI reports.

MEMBER RICCARDELLA: Is there something on the treatment of uncertainties?

MR. CUMMINGS: There is.

MEMBER RICCARDELLA: How do you treat

uncertainties?

MR. CUMMINGS: There is in terms of the treatment of uncertainties in your criticality analysis. However, we don't have anything in there about the treatment of uncertainties in BADGER or RACKLIFE. Because in that guidance document, we chose not to try to address the issue of how do you model degraded Boraflex.

So, if somebody wanted to try to model degraded Boraflex, they could use the guidance document. But anything associated with how they modeled degraded Boraflex would have to be under – would have to have that specific aspect reviewed by the NRC in conjunction with everything else that's in that application.

CHAIRMAN STETKAR: But, Kris, just to make sure I understand to follow up on what Pete asked, if they're using BADGER to monitor the status of Boral or some of the other –

MR. CUMMINGS: Right.

CHAIRMAN STETKAR: The guidance is silent on uncertainties in the measurements; is that correct?

MR. CUMMINGS: Well, that's not correct.

CHAIRMAN STETKAR: Okay.

MR. CUMMINGS: It's silent on – in the

neutron-absorber monitoring and specifically in situ testing, which is BADGER, we do have a proposal in there on how to use the uncertainties.

So, if you're actually trying to credit a degraded form of a neutron absorber, you know it's actually degraded, then we said you need to incorporate the uncertainties into your analysis. We haven't said how you do that, but we've just acknowledged that you need to incorporate that.

If you've got something like Boral or Metamic, we've said it doesn't make much sense to try to take a very large uncertainty test, apply those uncertainties when we don't have any operational experience that shows there's actually any degradation of that material.

SPEAKER: We should try to push on here, I think.

MR. CUMMINGS: Okay. Next slide. So, I’m here pretty much on my conclusions. We provided an alternative proposal to the NRC right before the subcommittee meeting.

Basically, we'd like to work with the NRC on coming up with an acceptable neutron monitoring program.

We think the generic letter should be

focused on those materials that are most susceptible. Specifically the Boraflex, Carborundum, Tetrabor materials.

And there's various licensees that we think could be excluded or provide a very simple response and that should be acknowledged explicitly in the generic letter and those subsets of licensees are included here.

And then for the remainder of those plants that don't fit those three, let them have the flexibility to answer the five bullet points that Matt talked about without the detailed information in Appendix A.

Next slide. So, in terms of my conclusions, we feel like the industry has responded relatively proactive to the operating experience and NRC notifications.

As you've seen from the licensees that are submitting new analyses or inserts to remove credit of Boraflex, Boral with 35 years of experience still continues to provide the same level of neutron absorber capability as when it was installed.

The newer metal matrix materials are relatively new. They don't have the decades of in-service material to start to see the degradation yet.

And we're going to continue to work on existing monitoring programs and industry research which we'll provide more information and inform both the industry and the NRC going forward. And we propose a risk-informed approach to the generic letter.

So, thank you very much. I'm more than happy to entertain any other questions. I apologize for going a little long.

MEMBER BALLINGER: Any comments from the Committee – questions?

MEMBER RICCARDELLA: If you were to go with a risk-informed approach, is there something like an acceptable probability of a criticality event like we have for reactor events? I mean, 10 to the minus sixth, 10 to the minus fifth?

MR. CUMMINGS: No. The approach that we take is that we will not have a criticality event.

MEMBER RICCARDELLA: Well –

MEMBER BALLINGER: So, that's zero risk.

MEMBER RICCARDELLA: Yeah, but no such thing as zero risk, is there, John?

CHAIRMAN STETKAR: Zero is a really small number.

MEMBER BALLINGER: Any questions from people in the – out in the room?

(No response.)

MEMBER BALLINGER: Is the – the bridge is open or can we get it open?

MEMBER SCHULTZ: While that's happening, Kris, do you agree with the discussion that we had on GALL 1 with the GALL 2 that GALL 2 boosted -- based on the NRC's input, boosted the expectations associated with the monitoring program and that those licensees that committed to GALL 1 may need to focus on something like GALL 2 for –

MR. CUMMINGS: I agree that there was a difference in GALL 2. Obviously they added the Boral – or the other neutron-absorber materials.

What I would need to do is go back and look at the survey that we did. Because one of the questions we did ask is, have you gone through license renewal and what did you commit to?

And my recollection from that is that the majority of the people whether they were GALL 1 or 2, they didn't specify, but the majority of the respondees who had gone through license renewal indicated they had adopted especially for Boral doing a BADGER test. So, one of the concerns we have going forward is, well, how do you take this highly uncertain test, apply it to Boral when you don't have any evidence of degradation of this material across the industry.

So, that's going to be something I know we're going to be going forward and discussing with the NRC. That's something we're trying to address in the NEI 12-16, but short answer is I don't think it's that clear that just because they were GALL Rev 1 that they didn't adopt an aging management program for their neutron absorbers, but I'd have to look at the details of the responses we got.

MEMBER SCHULTZ: Thank you.

MR. YODER: Well, it's agreed that you can't just draw a line and say people before this time did this or that. I think it's a mixed bag.

MEMBER SCHULTZ: Yeah, understood.

MEMBER BALLINGER: Okay. Any questions from the public? If there are, please identify yourself.

MR. SCHONBERGER: Yes.

MEMBER BALLINGER: Okay. Who is yes?

MR. SCHONBERGER: My name is David Schonberger.

MEMBER BALLINGER: Okay.

MR. SCHONBERGER: D-A-V-I-D. S-C-H-O-N-B-E-R-G-E-R. Member of the public. Some people suggest that Boraflex is a fiasco, and other people suggest that the problem was detected and it is being addressed. And, therefore, the regulation has worked as intended to ensure safety. On the other hand, I suggest that the ACRS is focused on the wrong risk mitigation issue.

The proper question should be how to expeditiously transfer spent fuel to open-frame, low-density configurations in dry casks. Thank you.

MEMBER BALLINGER: Thank you for that comment.

Any other comments from the public?

(No response.)

MEMBER BALLINGER: Thank you, and I guess we'll turn the meeting back over to Chairman Stetkar.

CHAIRMAN STETKAR: Thank you very much. Thanks to the staff for a good overview and discussing. And NEI, you condensed the material quite well for the full committee meeting.

We will recess. Because I was so generous this morning, we will recess and reconvene at our scheduled time of 1:45.

(Whereupon, the above-titled matter went off the record at 12:21 p.m. for a recess and went back on the record at 1:14 p.m.)

A F T E R N O O N S E S S I O N

1:14 p.m.

CHAIRMAN STETKAR: We are back in session. And the next topic on our agenda is the Safety Evaluation Report for Fermi Unit 3 Combined License App0lication. And the esteemed Dr. Michael Corradini will lead us through this session masterfully.

MEMBER CORRADINI: Thank you, Member Stetkar – Chair Stetkar.

Okay. Let me just give a short introduction. We've been looking at over the course of five subcommittee meetings, the Fermi application for a production operating license. And we have now essentially all the SER in with all open items closed. We also have access to a number of – access to all their documents.

What I have asked the licensee, the applicant to do is to mainly focus on what they presented to us in the last two meetings primarily, which is site characteristics and applicability, and the Fukushima near-term task force recommendations.

I won't see anymore. We have a limited time and there's a lot to go over. So, let me turn to Frank Akstulewicz, the staff. And, Frank, are you going to introduce the whole event?

MR. AKSTULEWICZ: Thank you, Dr. Corradini.

I'm not going to introduce the whole event, but I just want to make two comments. One is I want to extend our appreciation to the Committee for the quality work that was done in the review and oversight of the staff's review as it relates to the Fermi application. And we hope that at the end of the day, the Committee will find that the staff review was thorough and will support a recommendation to the Commission in terms of our ability to recommend issuing a license for the Fermi 3 plant.

With that, I'll defer back to you.

MEMBER CORRADINI: Okay. Thank you, Frank.

And so, Peter, will you be the one that will lead discussion for the applicant?

MR. SMITH: Yes.

MEMBER CORRADINI: Okay. Why don't you go ahead?

MR. SMITH: Okay. So, I'm Peter Smith, Director of Nuclear Development from DTE Energy. And I had the privilege of leading our combined license application project since its inception in late 2006.

And with me at the table I have licensing engineer from our organization, Nick Latzy, Steve Thomas, who has been the engineering manager for the entire project from Black & Veatch, and David Hines, an engineering manager from General Electric-Hitachi. I also have others here as well that we'll call upon if needed.

So, we were asked basically to – next slide, please – to give a short overview of our implementation of the ESBWR design and our – talk about our one departure.

Talk about site characteristics, principally flooding and seismic evaluations. And then later on in the agenda there's a separate item to talk about the Fukushima near-term task force recommendation implementation.

Next slide, please. So, Fermi 3 is a – implements the GE, General Electric-Hitachi ESBWR standard design at the Fermi site. And we incorporate by reference design – the DCD Rev – Revision 10. And overall our FSAR and the evaluations that have been done by the staff have reached the conclusion that ESBWR is well-suited for the Fermi site.

We've supplemented the DCD where necessary where the DCD requires additional information to address site-specific considerations.

And as I had mentioned earlier, we have one departure from the DCD and that was related to a reconfiguration of the internal arrangements of the radwaste building to accommodate increased low-level radwaste storage capability.

Next slide, please. So, I'll move on to site characteristics. Flooding. So, this actually is a depiction of the site. Fermi 3 will be co-located on the existing Fermi 2 site.

The Fermi 3 structures are in red. Fermi 2 is kind of the gray structure to the north and its cooling towers are to the north of Fermi 3.

The site is located on the western shore of Lake Erie. It's about 20 miles north of Toledo, Ohio. To the south it's about 25 miles to the city of Detroit. Partly in between, about 10 miles across the lake, line of sight to Canada.

To the north is Swan Creek, which is the local river that drains about 106 square miles of the area. And like I mentioned, we're on the western basin of Lake Erie, which is very shallow.

And we have used all of the current regulatory guidance to evaluate all of the flooding potentials and reached the conclusion that the flood levels are all below the requirements of plant Grade for safety-related and regulatory treatment non-safety system structures at the site.

Moving on to the other area where we had considerable site-specific effort was related to seismic. So, in our application we have in the last two years redefined our ground motion response spectra using the central and eastern United States seismic source characterization, using the EPRI 2004/2006 ground motion models and we followed NUREG-2117 guidance to incorporate new information into the seismic hazard model up through 2012.

And so, that information then we made the decision in 2012 that we would redo all of our site-specific structure interaction analyses. And so, we executed those over the last year, 2013. And they've been reviewed by the staff during 2013 and the first part of this year.

And the conclusion is, is that our ground motion response spectra, the foundation input response spectra and resulting site-specific in-structure responses are well-enveloped by the ESBWR standard plant design at the Fermi site.

So, if we'll move on to the next slide just for comparison, these are the Fermi 3 ground motion response spectra based on central and eastern United States seismic source characterization. That's the blue lines on the two figures. One is horizontal, one is vertical.

And the certified seismic design response spectra is in red above the site-specific GMRS, well-enveloping the GMRS.

MEMBER RICCARDELLA: About a factor of two.

MR. SMITH: Similarly, we constructed the Foundation Input Response Spectra for use in our site-specific structure interaction analysis. And you can see the – again the comparison.

The black line is the enhanced foundation input response spectra that were enhanced in accordance with the staff guidance. And it as well is bounded by the Certified Seismic Design Response Spectra.

And then finally through our SSI analysis we propagated this is an example of in-structure responses. In fact, these are the limiting in-structure responses for the reactor building, fuel building. And, again, there's considerable margin to the corresponded DCD in-structure response spectra which are in black. Ours are in red. So, we have substantial margin on both the inputs and the outputs of our seismic evaluations.

That's all I was planning to say about this. Now, I think the agenda we were going to break and then come back and later do the Fukushima.

MEMBER CORRADINI: Oh, you mean between you and the staff.

MR. SMITH: Yeah.

MEMBER CORRADINI: I don't know how the staff has this arranged. I think that's correct.

MR. SMITH: I think that's the way it was on the –

MEMBER CORRADINI: Okay. So, Tekia, your group is up next.

MS. GOVAN: Yes.

MEMBER CORRADINI: Okay. Questions before we let Peter and the folks in front of us go? Any questions by the members?

(No response.)

MEMBER CORRADINI: Okay. All right. So, we'll have NRR come up – NRO. Excuse me.

(Pause.)

(Comments off record.)

MS. GOVAN: Good afternoon, everyone. My name is Tekia Govan. I'm one of the project managers for the review of the Fermi Unit 3 COL application. And today the staff is here to present an overview of their findings in the area of flood and seismic evaluation that has resulted in an advance Safety

Evaluation Report with no open items.

The detailed review of these two areas are documented in chapters 2, 3 and 20 of the staff's advance Safety Evaluation Report.

The technical team consists of branch chiefs Aida Rivera, Diane Jackson, Rebecca Karas and Jim Xu. And the technical reviewers are Henry Jones, Joseph Giacinto, Sarah Tabatabai and Manas Chakravorty.

And with that, we will begin the presentation on Section 2.4, Hydrology, with Dr. Henry Jones.

MR. JONES: I'm Dr. Henry Jones. I was the lead hydrologist for this review. And so, hydrology, we looked at the sections on flooding, of probable maximum flood on streams, surge and seiche flooding, tsunami, channel diversions and the ice flooding in groundwater and accidental release of effluents into the groundwater.

There was no ice flooding or were there channel diversions. So, what you see before you are the items that we specifically brought up that had some values.

The first one is flood. We looked at the historical flooding, the individual types of flooding and the combinations of flooding phenomena. And we looked at runoff and also local intense precipitation.

And we verified that the runoff from the local intense precipitation which was at a value of 584.8 feet NAVD88, would not exceed the plan grade which was actually a 589.3.

Then we went on to look at the probable maximum flood on streams and rivers and the staff verified that the flooding from streams and rivers was approximately 579.4 and would not exceed the plant grade parameter of 589.3.

For surge and seiche flooding, the staff calculated a water level of 585.4 which agreed with the applicant. The maximum elevation that waves would break would be at 587. And runoff was a maximum elevation of 588.4. And these are below the elevation of 589.3.

And then for seiche, we looked at the natural period of the Lake Erie. Lake Erie has a natural period that runs from 29 to 124 seconds. And we also agreed with the applicant in that the period which you can get most with the meteorological phenomenon would be about 11 seconds. So, you would not create any seiche from resonance. And there's no seismic phenomena or anything that would actually induce seiche either.

As for a tsunami there based on the history of the area and the geological characteristics, there is no sloping of a slope or a landslide potential. There's no faults that would cause any updrafts to cause a tsunami. And there's no historical record of tsunami on the Great – Lake Erie or the Great Lake. So, we concluded no tsunami has been recorded and there is no threat from that hazard.

For groundwater, there is not going to be any dewatering used for this site. And the DCD requires that the groundwater level be at least two feet below the site grade.

The historical high groundwater level is 12.7 feet below. And the PMF elevation that we determined was 584.4, which may allow for perhaps maybe 4.4 feet below site grade. So, that wasn't an issue.

For accidental releases of liquid effluents into the ground, we verified that the radionuclide release simulations were adequately conservative. And we confirmed that none of the levels that would be required to reach those levels would reach any type of receptor nearby.

Any questions?

MEMBER CORRADINI: Questions form the staff – our staff members. Excuse me. John?

CHAIRMAN STETKAR: We're all your staff.

(Laughter.)

CHAIRMAN STETKAR: I'll wait until the end.

MEMBER CORRADINI: You'll wait until the end, okay. I knew you had a question.

CHAIRMAN STETKAR: I do. I actually have two.

MEMBER CORRADINI: So, we'll keep on going.

MS. TABATABAI: Good afternoon. My name is Sarah Tabatabai. I was the technical reviewer for FSAR Section 2.5.2. And our review focused on COL information item 2.0-27A which includes all of the seismic information that is used to develop the site-specific GMRS.

And our review also included the applicant's response to RAI 01.05-1 which addressed the Fukushima recommendation 2.1 seismic hazard reevaluation.

So that the GMRS presented in FSAR Section 2.5.2 was originally based on an updated EPRI-SOG 1986 seismic source model and the EPRI 2004, 2006 ground motion model.

In May of 2012, however, the NRC issued

RAI 01.05-1 which addressed recommendation 2.1 of the Fukushima near-term task force. And this RAI requested the applicant to evaluate the potential impacts of the CEUS-SSC model on the seismic hazard at the Fermi site and to modify the site-specific GMRS and Foundation Input Response Spectra if it's necessary.

The next slide. This slide just talks about some background related to the 2.1 seismic hazard reevaluation.

In response to this RAI, the applicant made major revisions to FSAR Section 2.5.2 which included an updated earthquake catalog, probabilistic seismic hazard analysis, site response analysis and GMRS reflecting the use of the CEUS-SSC model.

The staff's review of the applicant's RAI response is detailed in SER Section 2.5.2. And the next slide summarizes some of the highlights from the staff's evaluation of the RAI response, as well as FSAR Section 2.5.2.

So, as part of our evaluation, we developed a supplementary earthquake catalog which confirmed that the applicant's updated earthquake catalog adequately categorized the local and regional seismicity through 2012.

We performed confirmatory PSHA and the results are almost identical to the applicant's PSHA results for the distributed seismicity sources.

I just wanted to mention that at the time, we only had a partial CEUS-SSC model built into our in-house software.

So, in the next slide I'll just present the results using the full PSHA model to confirm our conclusion.

And we also performed some confirmatory site response calculations which were very similar to the applicant's results.

And as I mentioned before, we performed an additional staff confirmation after the SER was completed. And that involved developing a GMRS using our confirmatory PSHA results using the complete CEUS-SSC model, as well as the new EPRI 2013 ground motion model which came out next year.

Next slide. So, the figure on the next slide compares the staff's additional confirmation. And those are shown in the green curves. The light green curve is our GMRS using the EPRI 2004, 2006 ground motion model where the dark green curve, which is lower, is the staff's GMRS using the 2013 EPRI ground motion model, and the blue curve is the applicant's GMRS. And as you can see, both sets of curves are well below the ESBWR DCD CSDRS.

So, at this point, I wanted to mention a generic concern that came from the subcommittee meeting that given the significant margin between the CSDRS and the Fermi -- and the GMRS, it was not considered to be an issue for the Fermi site, but the generic concern relates to the seismic hazard curve uncertainty behavior and how it should behave as a function of spectral acceleration and spectral frequency.

So, in order to address this generic concern, the staff has proposed to the ACRS to conduct a technical discussion on PSHA including all the math behind it, as well as an example calculation.

So, I believe that discussion will be able to address both the concerns.

MEMBER CORRADINI: To show us the error in our ways.

CHAIRMAN STETKAR: Yes, that will certainly help, I hope, to the benefit of – and, thanks. I was afraid you weren’t going to mention it at all and –

MEMBER CORRADINI: He was ready for you.

CHAIRMAN STETKAR: I was ready and you knew it was coming anyway. So, for the benefit of the members who weren't at the subcommittee meeting, and the reason this is characterized as somewhat of a generic concern, is that we have now seen the seismic hazard analyses for three separate sites for combined license applications using the NUREG-2015 methodology with the updated central and eastern US seismic hazard sources.

All three, including Fermi, of those applications exhibit similar characteristics of the seismic hazard insofar as the uncertainty in the if you want to call it recurrence interval or the frequence – exceedance frequency of the ground motion does not increase appreciably as you go to very – from small accelerations to very high ground motions. And that's contrary to what one normally expects.

One normally expects that as you have much higher ground motion accelerations that occur at much lower annual frequencies, but because of the sparsity of the information available for really, really large earthquakes and the uncertainty in the methods that are used to characterize both the seismic sources and the transmission of the energy to a particular site, one would typically expect the uncertainties to increase quite substantially as you get higher accelerations and much lower annual frequencies.

We're not seeing that happen.

And furthermore, for example, in the Fermi-particular case, and there’s also evidence – I went back and checked in the other ones and the same thing.

Give you some examples that not only is it not increasing as a function of acceleration and annual frequency, the uncertainty, there's a dramatic difference when we look at the uncertainties characterized for low spectral frequencies.

So, for example, if I could say it, it would be good, but I'll use the term "hertz," because it does. At low hertz, for example, 0.5 hertz, we see a change in – and now I’ll put ratios of the 95th to fifth percentile in the uncertainty distribution for rather modest accelerations on the order of 0.0001g, on one-hundredth of one percent of one g, there's very low uncertainty. There's only about a factor of four in that ratio. This is for low hertz again.

If I get up to one g, which is a really, really big earthquake on the magnitude on the order typically of about seven or eight, there's a factor of 775. So, that's a pretty broad uncertainty.

If I go out to now increasing hertz going from 0.5 to one, to two and a half, to five, 10, 25 hertz, I see at that very high acceleration a decrease in the uncertainty from 776 at a half a hertz, down to about 17 at 25 hertz.

And the increase in uncertainty as I go form – because it’s not plotted at one one-hundredth of one percent of one g, it's only one-tenth of one percent, 0.001g at 25 hertz, the uncertainty is a factor of six. It increases to 17 as I go from 0.001g to 1g. I don't understand why we see that behavior.

In the subcommittee meeting, it was explained that at low hertz the seismic hazard is dominated by New Madrid in the particular case of Fermi, which is a very, very distant source about which there's a lot of uncertainty and I understand that. That's why we see the large uncertainties for very high accelerations at 0.5 hertz.

For high hertz, 25 hertz, let's say, it was explained that that hazard is dominated by much smaller, moderate acceleration close-in earthquakes within a couple hundred miles of the source. And I can understand why that contributes to rather low uncertainty at modest accelerations, because those are modest accelerations and we have evidence.

It does not explain why the uncertainty is small for very high accelerations. And if you look at the de-aggregation –

SPEAKER: When combined.

CHAIRMAN STETKAR: When combined. Well, when you look at the de-aggregation, you see that even at high hertz New Madrid is contributing more importantly to the high acceleration hazard.

And if New Madrid is very uncertain for low hertz, I don't understand why we're so much more certain about it for high hertz.

So, that's a long – for the benefit of those who were not at the subcommittee meeting as Sarah mentioned, I think it's – we do not either understand how the uncertainty is being developed in the actual calculations. And that's why we agreed to meet with the staff to really gain a good understanding of that.

This is now, as I said, this is the third site and they're all behaving the same way. So, it's not something that's Fermi site-specific the way they're doing the calculation because these sites are distributed – I don't want to mention the other ones, but they're distributed in very different parts of the country with very different locations relative to New Madrid and so forth. So, it's not a Fermi site-specific issue of this uncertainty.

In terms of our overall conclusion, indeed we – I boosted up uncertainties at the high hertz range. If you look at the plot here, the margins if we look in the kind of 10, 20, up to 50 hertz or so, is where the margins tend to get smallest in terms of the envelope of the DCD ground motion response spectrum compared to the site-specific.

VICE CHAIRMAN RAY: Does this have to do with transmisivity?

CHAIRMAN STETKAR: I don’t –

VICE CHAIRMAN RAY: The low frequencies versus –

CHAIRMAN STETKAR: The answer is I think so, but I still don’t understand why – there almost seems to be a transition point where the uncertainty is dramatically reduced.

VICE CHAIRMAN RAY: And I listened to what you said and that’s the conclusion I –

CHAIRMAN STETKAR: I suspect it's in the ground motion response models that are being used at high frequencies, but that's only a suspicion because I don't know how they do the math.

Let me finish the point here before – I boosted up the uncertainties at high hertz and still couldn't get the Fermi mean to exceed the red curve on this side.

VICE CHAIRMAN RAY: So, the red curve still bounds the site.

CHAIRMAN STETKAR: Yes. The margin is reduced. But as long as I apply sort of reasonable uncertainties that you typically see, I couldn't get it.

So, in terms of Fermi conclusions, I at least am comfortable that the site remains bounded by the DCD design parameters.

Sorry, I didn't want to interrupt. I knew you wanted to say something, but I needed to get that out.

VICE CHAIRMAN RAY: I wanted to slow you down. I think we can go ahead.

CHAIRMAN STETKAR: Oh, okay.

VICE CHAIRMAN RAY: I interrupted you anyway.

MEMBER RICCARDELLA: So, do I understand we’re going to have –

CHAIRMAN STETKAR: I'm sure it's untrackable what I said. And I do have pictures, but –

MEMBER CORRADINI: I want to move us along. To summarize, I think as Sarah said it is accurate, is that we had enough questions that we still weren't clear about the explanation, but it appears in all three, not only just Fermi. Therefore, we want to talk with the staff so we understand the process so we're clear that perhaps we're misunderstanding the calculational procedure.

But because of the site and because that the site response even with increasing uncertainties just by judgment still is bounded by the ESBWR generic curve, we're fine with this, with this particular application.

We just want to get clear this generic issue of why we're misunderstanding it.

CHAIRMAN STETKAR: The message here is if that margin was a lot smaller, in other words –

MEMBER CORRADINI: Right.

CHAIRMAN STETKAR: -- if one of those green-colored curves were – or the blue-colored curves was much higher, there might be a concern.

MEMBER CORRADINI: Okay.

MEMBER RICCARDELLA: So, to understand, we're going to have a subcommittee meeting on this topic?

MEMBER CORRADINI: We're going to have something.

CHAIRMAN STETKAR: We haven't scheduled it yet, but we will.

MEMBER CORRADINI: And you're invited.

MEMBER RICCARDELLA: Thank you.

MEMBER CORRADINI: No problem.

(Laughter.)

MEMBER CORRADINI: So, we're back with the staff.

MS. TABATABAI: Yes. So, this last slide just presents our conclusions. We concluded that the applicant has provided sufficient information to satisfy the relevant NRC regulations and reg guides. And the applicant has adequately addressed COL item 2.0-27A related to vibratory ground motion. And the applicant has also adequately addressed the recommendation 2.1 RAI.

MEMBER CORRADINI: Other questions for Sarah?

(No response.)

MEMBER CORRADINI: Okay.

MR. CHAKRAVORTY: Okay. Good afternoon.

VICE CHAIRMAN RAY: Good afternoon.

MR. CHAKRAVORTY: My name is Manas Chakravorty and I am a senior engineer in the Structure Engineering Branch.

I reviewed FSAR Section 3.7 and 3.8 of the Fermi 3 application. I provide an overview of this review.

Section 3.7 of the FSAR establishes the site-specific seismic input and the corresponding seismic demand for safety-related structures.

And Section 3.8 really establishes the capacity of the Category 1 structures to meet the seismic demand, as well as in combination with other rules.

So, let me go to the overview. Fermi 3 FSAR incorporates the ESBWR DCD Section 3.7 and 3.8 by reference, site-specific FIRS are bounded by the CSDRS as we discussed a little before, Fermi performed a site-specific SSI analysis to address the DCD backfill requirements because at the site, Fermi site, it was not met, and also partial rock embedment effect because that situation was not covered in the DCD. So, they needed to do a seismic analysis using the site-specific input.

And what we found is that site-specific seismic demands of the reactor building, fuel building, control building, as well as firewater service complex, they're all bounded by the standard plant design.

They have also done a sensitivity study with and without the backfill. And both cases were enveloped by this DCD demand.

Next. So, the major conclusions are finally we concluded that the applicant incorporated the DCD with proper supplementary information. And we reviewed and determined that this information is adequate. And we concluded that the applicant has provided sufficient information to meet the relevant ESBWR DCD requirements and the applicable regulations. And the standard plant design is adequate at the Fermi 3 site.

Any other questions?

CHAIRMAN STETKAR: Yes.

MEMBER CORRADINI: Mr. Stetkar. Chairman Stetkar.

CHAIRMAN STETKAR: Dr. Corradini, thank you.

I have only because this comes up in the staff's SER under Section 3.8. It's kind of an add-on. And in the SER, there is a discussion of the evaluation of hurricane-generated missiles for damage to Category 1 structures, and for damage to structures that house so-called regulatory treatment of non-safety systems or RTNSS equipment.

And there essentially was a requirement from the DCD that each – that Fermi perform a site-specific evaluation of hurricane-generated missiles to see whether or not the hurricane-generated missiles are bounded by the DCD hurricane-generated missiles.

And if anybody knows where the Fermi site it, it was not surprising that hurricane-generated missiles are bounded by the DCD hurricane-generated missiles because the peak hurricane winds evaluated very, very conservatively at the Fermi site are bounded by the DCD envelope.

There's a curiosity, though, that there's a footnote in Table 2.0-1 of the DCD that says tornado-generated missiles need not be evaluated for other than seismic Category 1 structures, in other words, either Category – seismic Category 2 or so-called non-seismic category structures.

So, the DCD does not evaluate tornado-generated missiles for damage to those non-Category 1 structures. Neither does the COL applicant, because they're not required to. Not surprisingly, tornadoes are kind of interesting at the Fermi site.

Some of the structures that house RTNSS equipment are evaluated for tornado wind loads. In other words, just wind pressure on the building. Some are evaluated only for hurricane wind loads. All of those structures are evaluated for hurricane missiles. None of them are evaluated for tornado missiles. This seems to, at least me, a curiosity and I'd like the staff to at least explain to us why that is.

MS. GOVAN: Chairman Stetkar, can I ask that we table that discussion to after Fukushima, because we actually have a slide that addresses your –

CHAIRMAN STETKAR: Okay. No problem at all. I didn't know when to bring it up. I brought it up here because it's under SER Section 3.8.4. It's kind of a place to put it, but that's fine.

MS. GOVAN: But we're ready to answer that question right after the presentation on Fukushima.

CHAIRMAN STETKAR: Great. Thanks. Sorry.

MEMBER CORRADINI: Other questions for the staff?

(No response.)

MEMBER CORRADINI: Okay. Back to the applicant.

(Pause.)

MEMBER CORRADINI: Peter, you're up.

MR. SMITH: Ready. So, we're going to address – talk about briefly the three Fukushima near-term task force recommendations. 4.2 relating to mitigating strategies for beyond design basis external events, 7.1 reliable spent fuel pool instrumentation, and 9.3 emergency preparedness.

So, for recommendation 4.2, the mitigating strategies, Fermi 3's application satisfies the applicable – or the requirements applicable to the passive ESBWR design including those mandated by Order EA-12-049 as amplified by the staff's interim guidance related to that order which endorses NEI 12-06, the industry guidance on implementing diverse and flexible coping strategies referred to as FLEX strategy.

So, the next slide, please. So, for the ESBWR, the passive design provides for a minimum coping ability without external AC power or any AC power for at least 72 hours. And the time periods beyond 72 hours can be addressed either by supplementing installed plant equipment with onsite, or the offsite resources that are repositioned as part of the FLEX strategy.

Next slide. Recommendation 7.1 relates to reliable spent fuel pool level instrumentation. And, again, we've taken this approach related to spent fuel pool instrumentation again that addresses the order amplified by interim staff guidance that again endorses NEI guidance for the implementation of spent fuel pool instrumentation.

And then finally on the emergency preparedness, recommendation 9.3, the staffing and communications assessments will be performed in accordance with NEI 12-01 guidance for assessing beyond design basis accidents of accident response staffing and communications capabilities.

The assessments will be completed at least two years prior to the scheduled initial fuel load and any modifications to the plant will be implemented at least 180 days prior to the scheduled initial fuel load.

CHAIRMAN STETKAR: And that, Peter, if I recall, that will some how incorporate both Unit 2 and Unit 3.

MR. SMITH: Yes.

MEMBER CORRADINI: For emergency.

CHAIRMAN STETKAR: For emergency, yeah. I mean, the subject of this slide –

MR. SMITH: Well, let me step back. What we did in our development, we developed a separate emergency plan for Fermi 3. It's very similar to the same plan for Fermi 2.

Both plants were going under some

significant evolutions at the time that we submitted the application. So, we kept them separate in the longer term.

CHAIRMAN STETKAR: I mean, obviously the big concern is coordination with staff and –

MR. SMITH: Right. And so, and we ended up doing exactly the opposite with our security plan because of the way things worked out. So, we have a combined security plan for Fermi 2 and Fermi 3 that is part of this application, but there were a lot of changes going on with the Fermi 2 plant at that time we were reviewing the application. So, we maintained that separation so that they will be coordinated plants.

MEMBER SCHULTZ: In the subcommittee discussion, more detail was presented on the integration of Unit 2 and Unit 3 emergency plants.

MEMBER CORRADINI: Other questions by the Committee members? Nothing?

(No response.)

MEMBER CORRADINI: All right. We'll turn it to the staff.

MS. GOVAN: Again for the record, my name is Tekia Govan, one of the project managers for the Fermi 3 COL application. And this group of gentlemen today will be presenting the overview of their findings for Fukushima recommendations that have resulted in the advance Safety Evaluation Report with no open items. The detailed review for these topics are documented in Chapter 20 of the advance Safety Evaluation.

The technical team consists of Branch Chief Antonio Dias, Technical Reviewers Angelo Stubbs, Raul Hernandez, Eric Schrader and Technical Team Leader Dan Barss.

We'll start with Fukushima 4.2 with Angelo Stubbs.

MR. STUBBS: Good afternoon. My name is Angelo Stubbs and I'm a reviewer from the Balance of Plant Branch of Division of Safety and Systems and Risk Assessment.

And I'd like to begin by summarizing the required provisions for mitigation strategies in Order EA-12-049. And that's what we have on the first slide. And the Order basically requires a phased approach to mitigation.

The initial mitigation would be performed with installed equipment. If needed, a transition phase mitigation would be -- could make use of portable onsite equipment to sustain the coping capabilities until offsite resources and offsite equipment can be made available.

And then once that's available, final mitigation would provide mitigation indefinitely, coping capability indefinitely.

So, let's go to the next slide. Now, evaluation for Fermi 3 for this recommendation, we found the design basis for Fermi 3 included passive design features and an inherent 72-hour coping capability for station blackout.

So, core, containment and spent fuel pool cooling will be maintained for at least 72 hours by passive design features without reliance on operator action or use of offsite equipment and resources.

So, 72 hours we could -- without any active equipment without any AC, coping can be established for the core, spent fuel pool and for the containment.

Satisfied mitigation after 72 hours, the staff imposed a license condition similar to the license condition revision imposed to the Summer's unit 2 and 3.

But in addition to what was proposed by the Commission, the staff also added additional requirements in the license condition to include a commitment to follow the staff interim guidance, ISG 2012-02 which was compliance for Order EA-12-049 with regards to the requirements and mitigation strategies for beyond design basis external events.

So, for post-72 hours offsite resources would be used in combination with whatever might be available onsite to assure mitigation for an indefinite period after that.

CHAIRMAN STETKAR: So, Angelo, just to make sure that – we had some discussion about this in subcommittee. For the benefit of the other members who weren't there, the SER basically endorses the notion that the ESBWR can maintain core cooling, containment and spent fuel pool cooling for 72 hours with no AC power.

MR. STUBBS: For a minimum of 72 hours. No AC power or operator action.

CHAIRMAN STETKAR: And period.

MR. STUBBS: Period.

CHAIRMAN STETKAR: Any further post-Fukushima mitigation strategies beyond 72 hours will be evaluated and worked out after the COL is issued; is that correct?

MEMBER CORRADINI: At least a year before fuel.

MR. STUBBS: At least a year before fuel, but the –

CHAIRMAN STETKAR: Well, after the COL is issued.

MR. STUBBS: But the mitigation will still be being accomplished with the passive systems. The design –

CHAIRMAN STETKAR: It will be accomplished through the passive systems up to 72 hours.

MR. STUBBS: Well, after 72 hours the passive systems are still the way we're going to be mitigating it is just that there will be a need to replenish water supplies and things like that also.

CHAIRMAN STETKAR: That's semantics, Angelo.

MR. STUBBS: Okay.

CHAIRMAN STETKAR: Somehow you need to get pumps and pipes and valves and things that, you know, other than massive human beings to mechanically pump the water. You need to get water from someplace to replenish water supplies.

MR. STUBBS: Right.

CHAIRMAN STETKAR: Which is normally considered some sort of active equipment.

MR. STUBBS: Right, you need to supply

water.

CHAIRMAN STETKAR: Right.

MR. STUBBS: But I'm saying the mechanism –

CHAIRMAN STETKAR: Recharge batteries which means you have to have some sort of diesel generators which generate electricity to recharge batteries, or bring in huge amounts of batteries.

Anyway, post-72 hours will be looked at after COL regardless of whether that's going to be accomplished from mobilizing centrally located equipment, or whether it's going to be accomplished using onsite fixed equipment such as RTNSS equipment like the ancillary diesel generators and other onsite equipment.

MR. STUBBS: Correct. And without –

CHAIRMAN STETKAR: We don’t know –

MR. STUBBS: -- NRC guidance there would have the possibility of using either.

CHAIRMAN STETKAR: Okay.

MR. STUBBS: Okay. And if we go to the next slide –

CHAIRMAN STETKAR: Now, the key is, though, this is for mitigation of beyond design basis external events meaning earthquake or tornado larger than the design basis earthquake or tornado.

MR. STUBBS: Yes.

CHAIRMAN STETKAR: So, therefore, if the applicant is going to include credit for RTNSS equipment which is stored in non-seismic Category 1 buildings that are maybe protected to the design basis earthquake and may not be protected against tornado missiles, if the applicant is going to include credit for that equipment, they better have assurance that the structures and that equipment will withstand earthquakes and tornadoes that are larger than the design basis; is that correct?

MR. STUBBS: Right now what we are looking at is we endorse guidance of NEI 12-06. And that's the standard that the existing plants are using.

And I guess the answer to your question is, there's no specific guidance to identify what beyond design basis level would need to be –

CHAIRMAN STETKAR: Thanks. That's what I wanted to get at.

MEMBER CORRADINI: That's what he wanted to get on the record.

CHAIRMAN STETKAR: That's what I wanted to get on the record. So, thanks for doing it.

MEMBER CORRADINI: Because that just for

the rest of the Committee members, that was kind of our discussion in subcommittee is that we understand the license condition, but fro the standpoint of the applicant there is yet to be determined guidance to know is it the design basis, is it above design basis, how much above it?

MR. STUBBS: But there is guidance in NEI 12-06. And that guidance, I believe, is to the design basis.

MEMBER CORRADINI: Correct. That's right.

CHAIRMAN STETKAR: Yeah, that's right.

MEMBER CORRADINI: Thank you.

MR. STUBBS: Okay. And the last slide is just a recap of the license condition.

MEMBER CORRADINI: Which I failed to summarize in a number of documents and failed miserably. So, thank you.

MR. STUBBS: Okay. But like I said, it was basically, you know, there was a license condition at Summer and this points out the guidance that was issued after Summer in the ISG and have been following that guidance.

MEMBER CORRADINI: Okay. Thank you very much.

MR. STUBBS: All right. Thank you.

MEMBER CORRADINI: Are there questions for – next on the list.

MR. HERNANDEZ: Hi, my name is Raul Hernandez from Balance of Plant, and I'll be presenting the Recommendation 7.1.

Basically, this is the history of the Order. There was the Fukushima lessons learned. They have a list of recommendations, including Recommendation 7.1.

The Commission decided that this item should be addressed earlier and they issued Order EA-12-051 Order Modifying Licenses with Regard to the Reliable Spent Fuel Pool Instrumentation.

The staff developed a guidance which endorses NEI 12-02. And this was big guidance that the staff used to evaluate the applicant's response.

The staff found that the Fermi 3 spent fuel pool level instrumentation meets all the design and programmatic requirements described in the Order -- described in the guidance, which is more specific than the Order, and, therefore, in compliance with the Order.

The ESBWR design incorporates safety-related instrumentation that already address most of the design features.

There were two design features that were not explicitly stated in the DCD, and the applicant expanded Section 1.5.1.1.2 to add the description of the capability to connect an outer power supply to the instrument, and the description that the instrument will retain its calibration after switching power sources.

This is for the Tier 2 Section 13.5 already addresses procedures, testing and calibration requirements to use this equipment.

The staff developed license condition 20.3-1 to address development and implementation of a training program to ensure that personnel will be trained in the provisions to establish alternate power connections to the level instrument. This is their own – this connecting alternate power was not part of the DCD. That's why it require specific training besides the one that is already covered by Section 13.5. That's why it was put apart.

During the subcommittee meetings, there were some questions related to the environmental qualifications of the spent fuel pool instrument.

The actual wording on the order states that the primary and backup instrument channels shall be reliable at temperature, humidity and radiation levels consistent with the spent fuel pool at saturation conditions for an extended period. This reliability shall be established through the use of an augmented quality assurance program similar to the fire protection program.

Fermi 3 incorporates by reference the ESBWR design which includes a passive spent fuel pool and buffer pool cooling which allows spent fuel pool to heat up and boil up to 72 hours.

At this time at 72 hours, the water level will be about a foot above the top of the fuel. So, you're going to have pretty high radiation doses. And the instrument was designed to still remain operational at those conditions. The spent fuel pool has set points as low as the top of the active fuel.

Like I said, this instrument that is part of the DCD is the one that the applicant is crediting to meeting Recommendation 7.1.

MEMBER BROWN: That's still inconsistent with radiation. I agree with everything else in there except the same comment I made in the subcommittee meeting.

The radiation levels are assumed based on the water being a foot above the spent fuel in the pool, which is I guess okay as long as you don't have any other problems and that this is a beyond-design-basis type action that we're dealing with and just radiation levels at the top of the spent fuel pool is not consistent with what we saw at Fukushima relative to radiation levels due to adjacent, you know, failures, casualties that resulted in high radiation levels.

MEMBER CORRADINI: That's the one point I was going to ask you and the staff about. So, I guess at the end of the subcommittee meeting we discussed the possibility of an analysis or an evaluation about the differences in radiation levels.

MEMBER BROWN: Yes. And the answer came back was, you know, this is kind of the response to our discussion, from what I can see on the consistent – this is you all's response to, hey, we meet the absolute letter of the law. However, however, it says radiation levels consistent with saturation conditions, but this is a beyond-design-basis type circumstance.

Temperature and humidity easily, you know, that's consistent. I have no problem with those. But the radiation levels are not consistent with what at least the information we got in previous meetings relative to the Fukushima spent fuel pool radiation levels where the instrumentation may be.

Now, if this was a – what I call a blacksmith technology-type set of instrumentation, in other words, the lever that goes up and down on top level with little, you know, mechanical switches that operated certain levels, you know, and a couple of pairs of wire that run out to a lightbulb somewhere, yeah, that stuff will – the cabling will survive for quite a while under the – so will the switches for quite a while.

If it's electronics depending on the type of sensor that's used, the electronics, all the other type stuff, it's very problematic.

Are you going to use hardened semiconductors? Integrated circuits? Is it a computer-based one? That stuff, you take any computer platform you find, put it in a radiation fuel like that and it won't last long forever at all.

MR. HERNANDEZ: It wouldn't be operational at those lower levels.

MEMBER BROWN: My problem might be operational at those lower levels because it's not right on top. The electronics is obviously not going to be sitting on top of the water, but where is it going to be? What type of sensors are they? Are they electronic-based sensors? Are they what I call more hammer and tongs or blacksmith sensors?

MEMBER CORRADINI: So, let me ask does the staff have a comment for Mr. Brown?

MR. DIAS: Hi, this is Antonio Dias. I'm branch chief at NRO. I may have a few extra clarifications.

We are not familiar exactly with the design of this instrumentation the ESBWR is going to be proposing, but there's another application, that I don’t know if you had the opportunity to look at, and that is actually more like a pneumatic instrumentation.

They're actually going to be sensing by difference in pressure. They will be sensing the level of the water and the instrumentation itself will actually be in a different –

MEMBER BROWN: Is it above water?

MR. DIAS: Um –

MEMBER BROWN: When you say pneumatic, that implies –

MR. DIAS: It's more like a tapping system.

MEMBER CORRADINI: It's a what?

MR. DIAS: I think you call it a tapping system. I’m not familiar with –

MEMBER CORRADINI: It's a differential pressure method.

MEMBER BROWN: Yes. Well, that can be –

MR. HERNANDEZ: And the instrumentation is in a different room.

MEMBER BROWN: I understand. My only point being is that the radiation level is assumed for the performance level of the overall instrumentation, not just the stuff that stick in the pool, has to be, in my opinion, should be consistent with what the radiation levels are expected to be in those rooms if we had the beyond-design-basis circumstances similar to what we experienced at Fukushima. That's all.

That's one data point. And I admit we, you know, you don't have a thousand analyses, but we've got one data point for a boiling water reactor that had very, very high radiation levels.

People couldn't come near the place. So –

MR. HERNANDEZ: I understand.

MEMBER BROWN: So, that's the point. So, in my personal opinion, okay, this is still an open item relative to the radiation levels.

Forget -- whatever they want to use ought to be consistent with the radiation levels. That’s –

MR. DIAS: And would be. This is safety-related equipment that, you know, at the time that it's procured, there will be, you know, definitely they have a QA process that will find that it's procured correctly. And the NRC will also, you know, they will find that there is an ITAAC assigned to safety-related instrumentations and this one is definitely part of that.

So, there will be verifications on that.

MEMBER BROWN: Then, Antonio, then I would suggest, okay, that the staff's response in whatever piece of paper you all write in your final documents, should take the point that the radiation levels should be consistent with wherever the level of technology of the instrumentation is located is juxtaposed to saying, well, whatever it is at the top of the spent fuel pool –

MEMBER RYAN: Are you looking for some concrete criteria like the instrumentation should be capable of withstanding X –

MEMBER BROWN: No, I'm saying whatever -- look at the information we have. Where is the instrumentation going to be located? What are the types of sensors that they're going to have at the spent fuel pool?

MEMBER RYAN: And you want to know that that setup will withstand X radiation levels.

MEMBER BROWN: Relative to our experience at Fukushima, okay. And I don't know what the numbers are, because we don’t have –

MEMBER RYAN: So, you're looking for criteria that's at the top of the very pile of reactors worldwide in terms of radiation levels.

MEMBER BROWN: The only ones I'm aware of are the Fukushima, you know, the Daiichi reactors that melted down and we had pretty high radiation levels.

MEMBER RYAN: We'll question about it, but, you know, that's, I mean, I'm just trying to get a sense – and I’m not criticizing your point, but, you know, that's an extreme.

So, where is the range, and where's the extreme?

MEMBER BROWN: No. I’m not – it was an extreme that actually happened. So –

MEMBER RYAN: I understand that.

MEMBER BROWN: -- you're right, it was an extreme.

(Simultaneous speaking)

MEMBER RYAN: -- design to try and reach that goal. I’m just asking where –

MR. HERNANDEZ: The staff has developed, you know, precisely to prevent the accident that happened on Fukushima to provide some alternative cooling. That's the purpose of Recommendation 4.2.

MEMBER CORRADINI: I think there is other questions and I know we have a public comments. So, I’m going to –

MEMBER REMPE: But I have one question.

MEMBER CORRADINI: I know you do, but I'm not going to – but you’re still in the batter’s box. You're not up yet.

MEMBER REMPE: Okay.

MEMBER CORRADINI: I think what Charlie is saying and I think we'll have to debate it amongst the members is whether this residual risk is acceptable or it's not acceptable, because there's a – you're saying there's a data point you want to design for the data point and –

MEMBER BROWN: I want a design based on our information available from the design viewpoint.

MEMBER CORRADINI: Okay.

MEMBER BROWN: It doesn't necessarily have to be that data point. It's just that you need to take into consideration the conditions.

MEMBER CORRADINI: Okay.

MEMBER BROWN: And say, okay, that's what we got there. Now, if I look at the design of this plant, where the stuff is going to be located, if a similar thing happened, would they be higher? Lower? What – there’s got to be some, you know, calibrated, eyeball, back of the envelope, some type of way to come up with something other than right at the top of the fuel pool.

It doesn't seem to make sense for the beyond-design-basis evaluation approach to this.

MEMBER CORRADINI: So, I think the staff understands the comment and now Dr. Rempe is up. Go ahead.

MEMBER REMPE: Okay. So, do you have some sort of temperature measurement associated with this water level? Because how do you know when boiling starts and then when boiling has lasted 72 hours and maybe you should start worrying about that things aren't quite working anymore?

MR. HERNANDEZ: Well, the spent fuel pool temperature, per se, was – let me say. The initial temperature is a key parameter when you are calculating how much water you need to maintain.

You start with the minimum water level – this is part of the DCD.

MEMBER REMPE: I'm an operator. I'm in the middle of an accident. When do I know if boiling has started, is that I'm getting to, if I don't have a temperature measurement? And does this water level system include a temperature measurement, or is there some other measurement already there that gives you temperature?

MR. HERNANDEZ: Temperature is not part of this system. You have a temperature measurement that is – you’ve got temperature control by test rate.

MEMBER REMPE: Is it actually a direct temperature measurement? At Daiichi, they didn't have a direct temperature measurement. It was a measurement in front of a cooling pump that was for the cooling system. It was not in the pool.

They flew planes overhead and did sensors to try and guess what the temperature was, too, but there was not a direct temperature measurement.

Is there a direct temperature measurement in this pool?

MR. HERNANDEZ: That is part of the DCD-specific design. I can – I know that the temperature is a tech spec control parameter, but I cannot tell you where the instrument is located.

MEMBER REMPE: Can someone from the plant

–

MR. HERNANDEZ: That's part of the DCD.

MEMBER REMPE: Can someone from the plant –

MEMBER CORRADINI: Can the applicant help us?

MEMBER REMPE: Or someone form GEH, maybe.

MR. HINES: Hi. This is David Hines from GEH. Yes, there is temperature monitoring in the spent fuel pool, I think was your question.

MEMBER REMPE: In the pool?

MR. HINES: Yes, there is spent fuel pool temperature monitoring, as well as the level monitor --

MEMBER CORRADINI; You're one for two.

MR. HINES: As well as level monitoring as was previously stated.

MEMBER BROWN: Of course the radiation levels that it's due to work in are probably unsatisfactory as well.

MEMBER CORRADINI: Okay. Dr. Rempe, did you have --

CHAIRMAN STETKAR: Once it gets to 212, it's not going to get a lot hotter than that.

MEMBER CORRADINI: -- another question?

MEMBER REMPE: No, I'm fine.

SPEAKER: I agree with that point, but that doesn't work for the level part.

CHAIRMAN STETKAR: Level I'll give you, but –

MEMBER CORRADINI: Okay. Tekia, we're back to you.

MS. GOVAN: We're moving on to Fukushima Recommendation 9.3 with Eric Schrader.

MR. SCHRADER: Hi, I'm Eric Schrader with headquarters NSIR as the lead emergency preparedness reviewer for the Fermi 3 COLA.

The staff reviewed the applicant's response to RAI 1.05-2 which was for the NTTF 9.3 staffing and communications for an event affecting all units on a site in a prolonged station blackout.

The applicant's response was a license condition stating that they would complete an assessment of both the equipment required for communications and capability, as well as the staffing at least two years prior to the initial fuel load. And then within at least 180 days prior to the initial fuel load have all corrective actions identified by the assessments completed.

Okay. The next slide. The staff reviewed the applicant's license condition and with a modification to the initial fuel load reference modified it to include the scheduling defined in 10 CFR 52.99(a) and 52.103(a) which established the date of the initial fuel load. So, it gave it additional detail to when that date was specifically going to be.

Based on that modification, the staff found the license condition as an acceptable approach because it provides – it conforms with a guidance in SECY paper 12-0025 and the endorse guidance in NEI 12-01 as you've heard many times earlier the guideline for assessing beyond-design basis accidents response staff and communication capabilities.

That's it, unless there's questions.

MEMBER CORRADINI: Questions from the Committee.

(No response.)

MEMBER CORRADINI: Let me – since we have one unclear point, I think, let me ask the applicant a different question.

What is the radiation field design for the level instrument? What is it capable of withstanding? Since we're arguing about technical basis, I'm kind of curious about what the current technical basis is.

MR. HINES: Hi, this is David Hines from

GEH. I can't state the actual radiation level. However, the conditions upon which the instrument is qualified is for condition of – for accident conditions -- equipment qualifications determined for accident conditions in addition as was stated previously, for boil-down of the fuel pool up to the top of the racks for the NEI guidance. The instrument is also qualified for that.

The placement of the electronics would be strategically placed such that it can survive that type of environment that I just described.

MEMBER CORRADINI: But you don't know that radiation field level.

MR. HINES: I don't know the number, right.

MEMBER CORRADINI: Okay. Is it able to get that number so that my colleague can feel better?

MEMBER BROWN: I don't know that I'll feel better or not because it's – you've got a sensor as well as electronics.

MEMBER CORRADINI: Right, but I think at least we want to know what's the current technical design base is.

MR. HINES: Although it's not a license condition or stated in the DCD –

MEMBER CORRADINI: Understood. I just want to know --

MR. HINES; -- the specifics of the design of the instrumentation –

MEMBER CORRADINI: -- what the number is.

MR. HINES: -- is not specifically committed in the license, but those conditions upon which it would be qualified, as I stated –

MEMBER CORRADINI: Okay.

MR. HINES: -- are part of the license. The actual instrument selection would be such that it can meet those conditions and we do have technologies that can survive those types of conditions where electronics are remote from those locations typically more in the control room-type area with the actual sensing device locally.

MEMBER CORRADINI: Okay. Thank you.

CHAIRMAN STETKAR: David, can I ask you something about the temperature instrumentation? Because I'm briefly skimming the DCD –

MR. HINES: I'm doing the same looking for the reference for your records.

CHAIRMAN STETKAR: It's in – I lost the section because I was looking for a table here, but it says that there will be temperature indication, but it also seems to indicate that the temperature is monitored as Dr. Rempe said on the inlet and the outlet of the heat exchangers.

MR. HINES: Well, there's certainly that temperature monitoring for –

CHAIRMAN STETKAR: It would be that, but I can't find something that says actual –

MR. HINES: I was looking for that in parallel as well and so I'm still in the process of looking for the –

CHAIRMAN STETKAR: Okay.

MR. HINES: -- place within the document where it states that, but –

CHAIRMAN STETKAR: I'll do my search again. I can find the paragraph quickly.

(Simultaneous speaking)

MR. HINES: -- the design, but I haven't found a reference yet. I was looking in parallel with this discussion.

MEMBER CORRADINI: Other questions for the staff?

(No response.)

MEMBER CORRADINI: Okay, Kris, you're going to do what I'm asking to open the line?

CHAIRMAN STETKAR: Well, we have one more thing.

MEMBER CORRADINI: Sorry.

CHAIRMAN STETKAR: I still need to get my tornado missiles –

MEMBER CORRADINI: I'm sorry. I apologize. There was a leftover item. Excuse me.

MS. GOVAN: Thank you, gentlemen. Actually two items that we want to discuss. If I could ask Ryan Nolan and Yui Law to join me at the front, please?

(Pause.)

MEMBER CORRADINI: We have one more last item, but that's fine. Assuming there's not a lot of crackling, we'll just deal with this.

MS. GOVAN: Okay. During the August 20th subcommittee meeting, we left with two items that we would get back to the ACRS Committee on relating to tornado missiles which will be second, and first we'll talk about the SSC list that was requested as part of the review for Chapter 3 following an OBE.

And with that, I'll turn it over to Yui Law who will be presenting that information.

MR. LAW: Okay. Good afternoon, everyone. My name is Yui Law. I work at GE in the Mechanical Engineering Branch.

At the last ACRS meeting there was a

question on how we close the open item 03.02.1-3 which has to do with a list that we request the applicant to provide to us for SSC that would have to remain -- continue safe operation during and following an OBE.

There are two issues with that open item. One is moral. At the Toyo, there was a little confusion between open item 03.02.01-3 and RAI 03.02.01-2 which talks about RTNSS equipment.

The staff has since revised the SER to clarify that open item which is actually discussed in another RAI, North Anna 03.02.01-7.

And the second issue with that was the list that is in Standard Review Plan 3.2.1 that we ask the applicant to provide to us, this is the list that – a list of SSC for safe operation during and following an OBE.

And based on the answer from North Anna 03.02.01-7, it talks about the regulation 10 CFR Part 50 Appendix S. In that appendix there is a regulation that says that if the OBE ground motion is set to one-third of the SSE, then the requirements associated with OBE ground motion can be satisfied without the applicant performing explicit response or design analysis.

And there was a question was asked by ACRS members on the adequacy of the regulations. And the staff has since done some research on it. And this is what we found.

There was a SECY paper that had allowed justifications on not using OBE as a design earthquake. If the OBE is set to one-third or less of SSE, there's a SECY paper out there that justify why the SSE actually bounds the OBE at the design standpoint.

So, when an earthquake happens, an inspection has to be – or a walk-down inspection has to be performed within eight hours on both safety-related and un-safety-related equipment. And there are two reg guides, 1.166 and 1,167 provide guidances on pre-earthquake planning and post-earthquake actions that the applicant have to take.

So, basically OBE served as a threshold earthquake so that when the earthquake happens and if the OBE is not exceeded and if the walk-down inspection indicate no damage to the safety-related and non-safety-related equipment, then a shutdown of the plant is not required.

And in those reg guides, it also endorses an EPRI report which also provides detailed procedures on what the applicant would have to do should an earthquake occurs and what kind of equipment they have to check.

So, basically this list that we asked the applicant due to OBE is essentially the same list as is a list for safety-related equipment which is provided in Table 3.2.1 and, you know, as a part of DCDs as well.

So, to sum up all of that, the staff feels that overall plant safety is still maintained because all safety-related and important safety-related SSC are bounded by the SSE during the design stage – well, SSE bounds to OBE when OBE is set to one-third of SSE. Therefore, overall plant safety is still maintained, you know, should an earthquake occur.

And that's what we found on the justification of why the OBE is not a design earthquake.

CHAIRMAN STETKAR: I don't have anything because of timing. I understand. It's kind of a convoluted process, but I think we understand.

MS. GOVAN: Okay. If there are no questions, we'll move on to the next item with Ryan Nolan.

MEMBER CORRADINI: The one we've been waiting for.

MS. GOVAN: Yes.

MR. NOLAN: My name is Ryan Nolan. I'm in the Balance of Plant Branch and I have review responsibility for external missiles generated by winds.

What we have here is a slide discussing the protection of RTNSS B SSCs for winds and missiles. Fermi is not taking any departures. And so, what I'm presenting here is what's in the DCD for ESBWR.

All RTNSS B systems are either in seismic Cat 1 structures or seismic Cat 2 structures. Seismic Cat 1 structures are designed to a tornado wind of 330 miles an hour and associated tornado missiles.

CHAIRMAN STETKAR: Ryan, for the benefit of the committee who doesn't understand what RTNSS B or why RTNSS B is RTNSS B, could you explain what RTNSS B equipment is as opposed to other RTNSS equipment?

MR. NOLAN: RTNSS B is used for long-term safety. It's there to get you from 72 hours to seven days.

CHAIRMAN STETKAR: Thank you.

MR. NOLAN: For RTNSS B systems that are in seismic Category 2 structures, those structures are designed to a tornado wind of 330 and a hurricane missile of 195, which is a Category 5 hurricane. And it was found acceptable using the guidance at the time. And I'm assuming the question is, what is that guidance? Can you talk about it a little bit more?

In that case, we can go to the backup slide. So, we refer to it as the Callan memo. And it was basically a memo that clarifies a SECY paper. And the SECY paper was written specifically for AP 600. And the Callan memo clarifies how to treat RTNSS B systems per 72-hour SSEs.

And the Callan memo says that for RTNSS B structures, they do not need to be designed for tornadoes, but they should be designed to a Category 5 hurricane.

And so, ESBWR, their design, they actually do design, they actually do design it for a tornado wind load of 330. And they use a missile speed which is the Category 5 hurricane missile speed.

MEMBER CORRADINI: So, what is an allowable – what I'll call an allowable apparent inconsistency.

MEMBER BLEY: Well, I guess I'm just confused about this and I wasn't at the subcommittee meeting.

CHAIRMAN STETKAR: We were there and we're confused. So, don't feel bad.

MEMBER BLEY: Designing for tornado wind to pretend that it generates no missiles? That's what this implies.

MR. NOLAN: Well, that's how ESBWR chose to design their structures. The Callan memo says that you don't have to design RTNSS B for tornadoes.

At the time, you know, tornadoes are 300 miles an hour and said, eh, but we feel that you should design it to a Category 5 hurricane.

We have operating experience that shows Turkey Point with Hurricane Andrew, the hurricane broadly affected a region and we don't – we feel that your structure should be designed to a Category 5 hurricane.

MEMBER CORRADINI: That's why I used the term "apparent inconsistency." The decision was that hurricane missiles were abound.

MEMBER BLEY: What the heck is the Callan memo? What kind of document is it?

MR. NOLAN: It was a memo from the EDO to the chairman. And it clarified how to implement discussions within the SECY paper.

It was specific to AP600 at the time, but the Callan memo clarified how to treat post-72-hour SSEs.

MEMBER CORRADINI: Does that help you?

MEMBER BLEY: Not even a little bit.

MEMBER CORRADINI: I think the way I understand it – oh, is Mark going to say something?

MR. NOLAN: Mark, our RTNSS guru.

MEMBER CORRADINI: You're going to help us, Mark, right?

MR. CARUSO: I hope.

Mark Caruso of the staff. When the staff set up their Commission paper on the post-72-hour – the treatment of post-72-hour RTNSS B SSCs, apparently there was – it was written in a way that was confusing to some people and there was a difference of opinion as to whether or not the staff was saying that you needed to design the stuff to completely reach GDC 2.

In which case, there was a question about, well, what exactly in terms of external events do they have to meet? Some people were saying they interpreted it to mean they had to meet all of GDC 2.

And so, that was the reason for the clarifying memo to say, this is specifically what the staff is saying, you know, the RTNSS non-safety-related stuff needs to satisfy.

MEMBER CORRADINI: And just to broaden it, the AP-1000 design certification and ESBWR design certification both fit within this.

MR. CARUSO: Yes.

MEMBER CORRADINI: Okay. So, we seem to have – we were unclear and this is what we have been – or this is the clarification.

MEMBER BLEY: So, there is a paper trail that shows how this happened to come about.

MEMBER CORRADINI: Correct.

MEMBER BLEY: But nota a logic trail.

MEMBER CORRADINI: And the applicant followed the allowable –

MEMBER BLEY: Paper trail.

MEMBER CORRADINI: Well, followed the staff's guidance at that point.

MEMBER SCHULTZ: Ryan, what I heard you say is that in the box where we said tornado design feature not applicable specifically excluded in the memo, the memo addresses it and says we're not going to address – we're not going to – this is going to be excluded here because it is bounded by the wind loading of the hurricane.

MR. NOLAN: No. No.

MEMBER SCHULTZ: It does not say that.

MR. NOLAN: No, it's not bounded. The post-72-hour – this is from the memo.

MEMBER SCHULTZ: That's what I want to

hear.

MR. NOLAN: Post-72-hour SSCs will not be required to withstand tornado loads or tornado missiles, but wind borne missiles from hurricane winds would have to be considered.

CHAIRMAN STETKAR: It's probably because people were aware at that time in calendar history of Hurricane, I forget, Andrew or whatever went through south Florida.

People at that time probably weren't thinking of EF-5 hurricanes that have flattened, you know, big towns in the Midwest and –

MR. NOLAN: Right. And it's almost a graded approach. It's non-safety by nature. RTNSS is non-safety. And so, they said that it doesn't have to be designed to a 300-mile-an-hour tornado, but it – you should consider a hurricane which is slightly less.

MEMBER CORRADINI: So, that's it. Mark, you're back up.

MR. CARUSO: May I offer one more thought. Mark Caruso. So, as you know in your review of SRP 19-3 that we came to this issue, too, and we at – we were about to issue an after-public comment. And internally we decided that we should treat – tornadoes should be treated. And so, we, as you know, the guidance we have now is different than what's in the Callan memo.

And in that process, we try to go back and say, you know, what was the logic here? And, frankly, we didn't find out that much, but there were a few people we talked to from back in the day. And the only thing I heard that made some sense to me was that the thinking at the time was that there is more concern about the hurricane, and that's why it was a Category 5 hurricane was specific, because of the ability to bring things in from offsite. And that's what the whole four days is about.

And that with tornadoes, you know, it's a little bit of a different situation. You probably still have loss of offsite power, but that's the only thing I heard that made me think, well, maybe that's what they were thinking was that I, you know, I can't hit everything with a tornado missile and I might have something else. It's non-safety, it's long-term, I'm going to have to make some decision about treatment here and I may be able to get things from offsite easily – more easily with a tornado.

Remember they're not allowed and the rules are nothing from offsite until you get to the seven days. So, I leave you with that thought.

MEMBER CORRADINI: Other questions from the committee?

(No response.)

MEMBER CORRADINI: I want to save time. We do have public comments and I want to make sure. So, let me go again. Members, do you have any questions for the staff?

(No response.)

MEMBER CORRADINI: Okay. So, now this time I think you are done. Thank you very much, Tekia. I appreciate it. Thank you to all the staff and the applicant.

At this point, we'll open the phone, the bridge line. I'm looking in the audience. I don't see anybody – oh, there is. I’m sorry. Excuse me.

So, first, if I may, let me first go with the phone line since we have it open. I know I was told that Mr. Schonberger was going to make a comment.

Mr. Schonberger, are you on the line?

(Comments off the record.)

(Pause.)

MEMBER CORRADINI: Do we have only one person in attendance here, or is there another one that wants to make a comment.

So, while we're still – okay. So, you go find him. We'll go for the onsite comment. So, please identify yourself, sir.

MR. KAMPS: Thank you, Dr. Corradini.

Is this on?

MEMBER CORRADINI: I think. Tap it.

(Comments off record.)

MR. KAMPS: Thank you, Dr. Corradini and Chairman and staff members for this opportunity. My name is Kevin Kamps with Beyond Nuclear. I also serve as a board member of Don't Waste Michigan and I think I'll just limit my comments here to a few items.

I just wanted to set the record straight on seiches on the Great Lakes. An NRC staffer today presented that there are no seiches on the Great Lakes. I believe I heard him that way.

That's just actually incorrect. So, you know, I can quote an ABC News 5 TV report from May 31st of 2012, which was about a May 27th, 2012, seiche on Lake Erie. A seven-foot seiche wave that extended from Madison to Perry to Fairport Harbor to Grand River, Ohio.

They're also referred to as edge waves. They can occur on any of the Great Lakes. They're most common on Lake Erie because it's shallow and of course the western basin is the most shallow part of Lake Erie. A part of the article, put it this way, Ohio is no stranger to these types of waves.

So, 10-foot plus waves throughout Ohio history. 1942, two seiche waves in Ohio from Bay Village to Conneaut. Madison on the lake again bore the brunt of these seiche waves.

The first wave to hit, this is 1942, was four to 20 feet tall. The second wave to hit 15 minutes later was six to eight feet tall.

And the 2012 seiche wave did carry several children out into Lake Erie, but they were rescued. Thank goodness. But in 1942, seven people were killed.

1954, a large edge wave struck downtown Chicago of all places. Southern Lake Michigan. 10-foot waves on the North Avenue Pier in the heart of downtown Chicago. Eight people killed.

And per the subcommittee testimony I gave recently, the white hurricane of 1913 in Goderich, Ontario, a 30-plus-foot wave on Lake Huron.

Of course I mentioned the Anishinaabe tribes of Michigan who experienced the New Madrid giant waves as they referred to them on Lake Michigan and I believe other of the Great Lakes.

I experienced myself the January 2014 giant waves, I guess you could say, from the Polar Vortex on Lake Michigan in the range of 30 feet tall.

Super Storm Sandy of recent years, 25-foot waves in Michigan City, Indiana. And perhaps the most famous giant waves in population culture would be behind the song about the loss of the Edmund Fitzgerald, the witches of November.

And a part of the theory as to why that ship went down in Lake Superior was the size of the waves lifted the boat up in the air and the center of the boat gave and broke in half. So, there are giant waves on the Great Lakes.

And I did want to tell John the tornado missile issue, the subcommittee members will remember that I myself being from Michigan, I've lived through tornadoes in this exact area.

June 1998 tornado, the funnel cloud passed between the containment building, the shield building and the cooling towers at Davis-Besse in Oak Harbor, Ohio and caused a very serious situation at that plant that went on for a couple days because of loss of the electric grid, as well as failure of the emergency diesel generators.

The final diesel to give up the ghost did so an hour after the grid was restored a couple days later. That's how close it came at Davis-Besse in June of 1998.

And in June of 2010 a tornado struck a pretty direct hit on the Fermi Nuclear Power plant doing damage to the turbine building, for one thing.

And I guess the final thought I'll share is there was reference made to – one of the NRC staffers again said – and I believe I'm forgetting the context right now.

He pointed to quality assurance and ITAAC as the final safeguards at Fermi 3. And it has to be put on the record that our group, Beyond Nuclear, and several others intervening against the Fermi 3 COLA before the Atomic Safety and Licensing Board, have raised quality assurance failures at Fermi 3 as a very serious concern.

There has been freefall in quality assurance for long stretches of time on Fermi 3 projects.

So, to rely on quality assurance and ITAAC at Fermi 3 as a final line of defense is very risky business. Thank you.

MEMBER CORRADINI: Thank you, sir. So, I think – well, I want to go to – I don't think there's anybody else in the audience here that has public comments. So, I want to turn to the phone line and I hear there's somebody out there.

Mr. Schonberger are you –

MR. SCHONBERGER: Yes.

MEMBER CORRADINI: Okay. So, before you go ahead, let me just see if there's others.

Is there anybody else that wants to make a comment?

MR. KEEGAN: Yes. Michael Keegan with Don't Waste Michigan.

MEMBER CORRADINI: Okay. So, Mr. Keegan, you hold up. You're second. Mr. Schonberger is first. Anybody else besides Mr. Keegan and Mr. Schonberger?

(No response.)

MEMBER CORRADINI; Okay, Mr. Schonberger. You can go ahead, please.

MR. SCHONBERGER: All right. Thank you.

Chairman Stetkar and members of the Committee, my name is David Schonberger. I'm speaking today as a member of the public who resides within a 50-mile radius of the Fermi site.

I submitted an electronic copy of my written comments in advance of today's meeting so that my public submission will be included on the record.

MEMBER CORRADINI: We have that in front of us.

MR. SCHONBERGER: Oh, excellent.

Okay. Well, in my oral comments right now, I would actually like to reference the major report recently released in July 2014 by the National Research Council of the National Academies titled "Lessons Learned from the Fukushima Nuclear Accident for Improving Safety of US Nuclear Plants."

That committee's report fundamentally endorsed the beyond-design-basis event planning, severe accident prevention and consequence mitigation.

The report recommends particular attention to improving the availability and reliability, as well as the redundancy and diversity of specific nuclear plant systems.

In my written comments, I outlined some of the many NAS recommendations which unfortunately have not been fully and verifiably implemented at Fermi Unit 2, Fermi Unit 2, which is an aging Fukushima-style GE Mark I BWR vulnerably located on an international border with well-known design flaws exacerbated by a reracked, closed frame, high-density elevated spent fuel pool with weak safety margins making Unit 2 an ideal candidate within the overall US fleet for expedited transfer of spent fuel from wet storage pools to dry cask post-Fukushima.

So, the Fermi Unit 3 COLA being discussed today as it stands, proposes to locate a new reactor and spent fuel pool immediately adjacent to Unit 2 at the same site, therefore creating a Fukushima-style multi-unit complex located near major metropolitan, densely populated cities.

So, in my written comments, I make a compelling case that the Fermi Unit 3 emergency plan for response to a severe accident deserves further analysis by the ACRS prior to ACRS endorsement of the COLA, and that the applicant's implementation of Fukushima NTTF recommendations is inadequate, inconsistent and unrealistic respectively for 4.2, 7.1 and 9.3.

But right now in my oral comments, I want to raise a slightly different concern which would be an excellent topic for Friday morning, tomorrow's discussion of Item Number 6 pertaining to internal personnel matters within the ACRS.

I propose that Chairman Stetkar open a discussion about the appearance of ethical conflict in allowing the esteemed Dr. Michael Corradini to serve as the chairman of the ACRS subcommittee which reviewed the Fermi Unit 3 COLA.

Dr. Corradini also served as a contributor, preparer with substantive involvement in the creation of the National Research Council's report which I referenced earlier.

My concern is that Dr. Corradini is in an awkward and conflicted position of reconciling the incongruity of endorsing the Fermi Unit 3 COLA as it stands while at the same time accepting Fermi Unit 2's delayed and incomplete compliance with the recommendation of the NAS report.

This is a travesty and I believe that full implementation of Dr. Corradini's NAS recommendations must be applied to Fermi Unit 2 as a prerequisite for ACRS endorsements of the Fermi unit 3 COLA.

On the subject of uncertainties pertaining to CEUS seismic source characterization model at the Fermi 3 site, my written comments explain that the most significant uncertainty associated with the CEUS SSC model is that it does not include any demonstration sites applicable to the Fermi site. And, therefore, the impact of the CEUS SSC model on the Fermi 3 seismic hazard is simply unknown.

Confirmation of seismic qualification has not been achieved and must be a prerequisite for ACRS endorsement of this COLA and not be allowed to happen post-COL in a license condition or otherwise.

Regarding reliable spent fuel pool instrumentation pertaining to radiation tolerance of the electronics, please note that the same identical shenanigans are going on right now with the Fermi Unit 2 spent fuel pool.

So, this issue is not going away and thank you for listening.

MEMBER CORRADINI: Thank you, Mr. Schonberger. I think we still have another gentleman on the line.

MR. KEEGAN: Yes.

MEMBER CORRADINI: Go ahead identify yourself, please.

MR. KEEGAN: Yes. This is Michael Keegan with Don't Waste Michigan, an intervener on the Fermi 3 COLA. I echo the comments that have been made thus far and wish to add to the concerns about seiches.

In 1972, the Davis-Besse Nuclear Plant was underwater for about a month because the straight-line winds had flooded the plant. Fermi is just up the road from that.

Additionally, I hear that there's no risk of tsunami and I harken to the fact that there are bluffs in the Great Lakes. And there are bluffs on Lake Erie nearly a hundred feet tall at Erie Bluffs State Park, a mile of bluffs 90 feet tall. There's Perry Township, Stanley, Ontario, John Pearce Park, at least four locations, local locations where there are bluffs that could collapse and could fall into Lake Erie and generate a tsunami. So, the flood concern I believe is real and has been glossed over.

What I've been trying to get answers to questions for going on five years is the enrichment level of the fuel to be utilized at Fermi. Will it be enriched? To what level? Will this be MOX fuel? Will this be high-burning fuel? And no one will answer that question. Either they don't know the answer, or they will not, but it seems to be – I’m waiting for the paper to stop rustling.

Thank you. It seems to be just fundamental what octane level you're going to be running in the reactor and withheld from the public.

In addition, I've been unable to get a comment as to the one million gallons of water above the reactor that would be there if storage, essentially eight million gallons – or eight million pounds, rather, how will that respond in a seismic event? That has not adequately been addressed.

I have concerns about the transmission corridor, the total avoidance of looking at the transmission corridor and it's essentially been chopped out of the equation.

All of the transmission lines are going to be on one corridor, so there's potential for a single fault. And so, the utility argues that the design of the reactor is passive gravity-driven and that AC power is not really needed and we have 72 hours of power onsite.

MEMBER CORRADINI: You're breaking up, sir.

MR. KEEGAN: Okay. And so, it can't be assumed that the passive nature of the gravity-driven pumps are going to work and supply enough coolant to that – should I just talk over the rustling papers, or should I wait for the rustling papers to stop rustling?

CHAIRMAN STETKAR: We can hear you fine if you just don't fade in and out.

MR. KEEGAN: Okay. All right. Very good. I just didn't know if the rustling -- okay. So, the assumption that you don't need A/C power because you have gravity-driven pumps has never been challenged, never been looked at, never been scrutinized, and that needs to be looked at.

Dr. Edward Lyman with Union of Concerned Scientists raised this issue at Victoria Station about the ability of the ESBWR to supply that if the water surpassed the needed without having electricity, that's problematic.

So, there have been a multitude of open issues and I would just like to highlight the point that the quality throughout of the inspections at General Electric, the steam dryers, the deception that went on there, in 2009 General Electric was cited for quality assurance problems.

A month earlier Detroit Edison was cited for violations on the quality assurance. In December, I believe it was the Office of Inspector General found that the NRC themselves lacked quality assurance background and abilities.

So, the point is, ACRS, you've got to look at all the –

CHAIRMAN STETKAR: Sir, either get a little closer to your microphone, or a little further away, because you're breaking up again and it's on your end.

MR. KEEGAN: Okay.

CHAIRMAN STETKAR: Thank you. That's good.

MR. KEEGAN: Okay. My point about quality assurance, it's been lacking throughout at General Electric, at Fermi, at the NRC. So, do not assume that those processes caught items.

ACRS, you're the final backstop here and we are challenging that quality assurance itself before the NRC Commission and we extend the challenge that in Appellate Court, this is the Supreme Court, we have a rock solid case that there is quality assurance lacking at the Fermi 3.

There was quality assurance lacking at the Fermi 2 and we're prepared to demonstrate that right from inception.

So, don't put the rubber stamp on this thing. This is a boondoggle. Do not put the rubber stamp on it. Scrutinize it. Do your job. Thank you.

MEMBER CORRADINI: Thank you, sir.

Is there other comments from the open phone line?

(No response.)

MEMBER CORRADINI: Okay. Thank you very much. So, with that, I think we're done.

Do I have any more comments from the members? If not, Mr. Chairman, back to you.

CHAIRMAN STETKAR: Thank you. And that concludes our session for the record. We will recess until 3:15 and come back and start working on letters.

What I'd like to do is tee up the Fermi letter first so that we have the benefit of the folks who are here and want to hang around and listen to that. We recess until 3:15.

(Whereupon, the above-titled matter went off the record at 2:58 p.m.)

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Qualitative Consideration of Factors in the Development of Regulatory Analyses and Backfit Analyses

ACRS Full Committee Meeting

September 4, 2014

Purpose/Outline

- Purpose
  - Provide an overview of SECY-14-0087, “Qualitative Consideration of Factors in the Development of Regulatory Analyses and Backfit Analyses.”
- Outline
  - Overview and Status
  - Background
  - Qualitative Consideration of Factors by the NRC
  - Federal and International Agencies
  - Scenarios Involving Qualitative Consideration of Factors
  - Conclusions
  - Staff’s Proposal
  - References

Overview and Status

- Staff submitted SECY-14-0087, “Qualitative Consideration of Factors in the Development of Regulatory Analyses and Backfit Analyses,” to the Commission on August 14, 2014.
- Notation Vote SECY paper with four enclosures
  - Seeking Commission approval of staff’s proposal

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Background

- SRM-SECY-12-0157 directed the staff to "seek detailed Commission guidance regarding the use of qualitative factors [in regulatory analyses and backfit analyses] in a future notation voting paper"
  - Scope of this paper includes regulatory analysis and backfit analysis for all NRC regulated activities
- Context
  - Part of staff's plan for updating cost-benefit guidance, SECY-14-0002
  - Linked to SECY-13-0132 (NTTF Recommendation 1) and RMRF due to defense-in-depth
  - Public Meeting on Qualitative Consideration of Factors held in May 2014

Qualitative Consideration of Factors by the NRC

- NRC guidance notes that even inexact quantification with large uncertainties is preferable to no quantification.
- Staff qualitatively considers factors which are not quantified in regulatory analyses and backfit analyses.
- Current practice consistent with NRC guidance and Commission direction
  - NUREG/BR-0058, Revision 4, “Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission”
  - SECY-77-388A, “Value-Impact Guidelines” instructed to quantify factors and qualitatively consider factors
  - SRM-SECY-93-086 allowed for qualitative consideration of factors for backfit analyses within the “substantial increase” criterion

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Qualitative Consideration of Factors by the NRC *cont.*

- NRC Risk-Informed Decisions
  - Commission Safety goals and PRA Policy Statements discuss importance of qualitatively considering factors
  - Reg. Guide 1.174 notes decisions are expected to be made in “an integrated fashion”
- Adequate Protection Determinations
  - Limited to public health and safety and common defense and security matters; determined at the Commission’s discretion
  - Only related quantitative measure is the power reactor safety goal surrogates to the quantitative health objectives
- Cost-Justified Substantial Safety Enhancements
  - NUREG-1409 states that the backfitting rule does not require a strict quantitative analysis

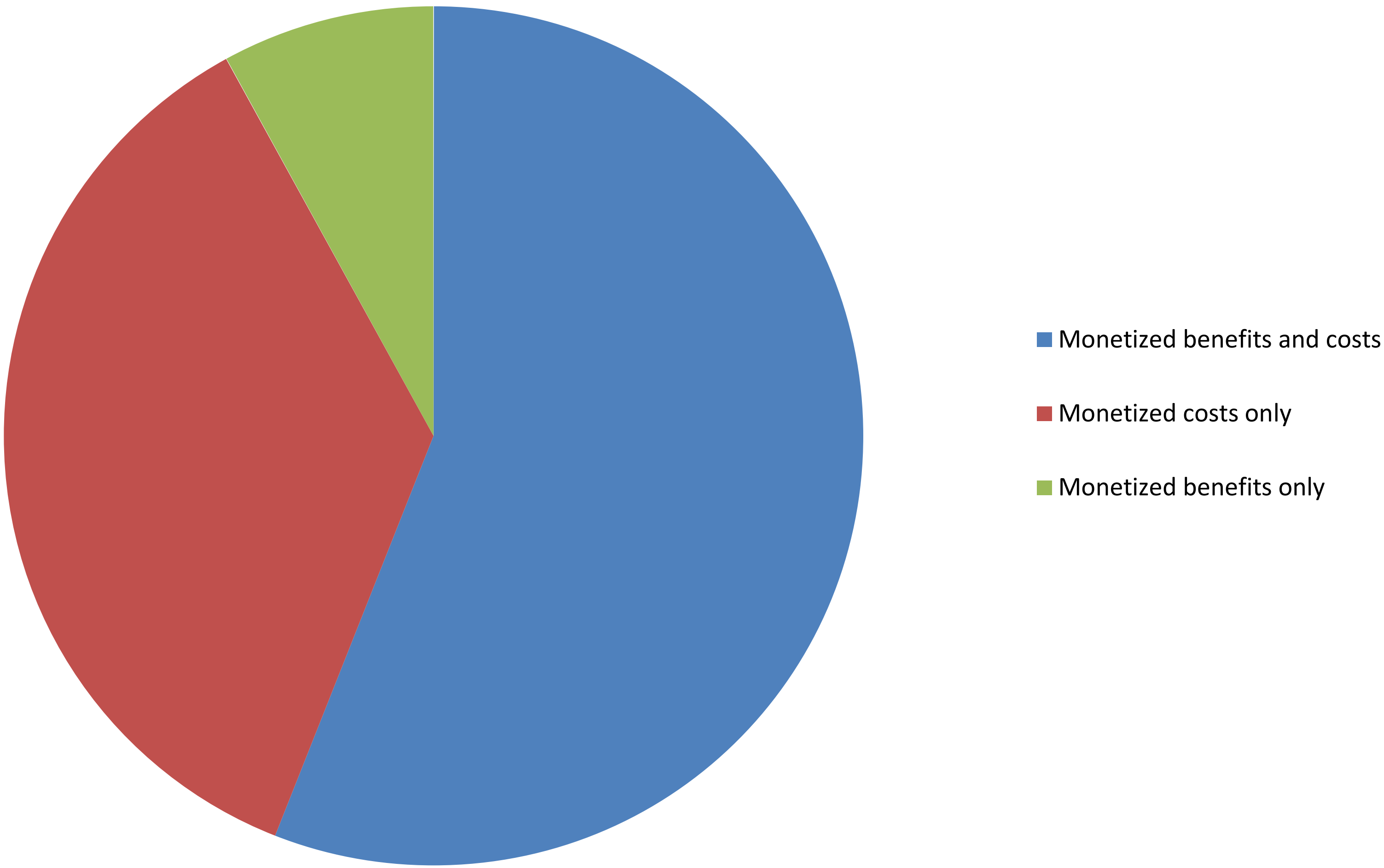
Qualitative Consideration of Factors by the NRC *cont.*

- Enclosure 1 of the SECY paper provides a list of past NRC regulatory actions that rely upon the qualitative consideration of factors
- Examples of factors that are difficult to quantify
  - Defense in depth (DID)
  - Increased security capabilities
  - Increased public confidence
  - Increased regulatory effectiveness

Federal and International Agencies

- Documents that require or recommend the use that federal agencies qualitatively consider factors
  - Executive Order (EO) 12866, “Regulatory Planning and Review”
  - Office of Management and Budget (OMB) Circular A-4, “Regulatory Guidance”
  - Office of Information and Regulatory Affairs (OIRA), “Regulatory Impact Analysis: A Primer”
- Importance of qualitative considerations is recognized internationally
  - OECD/NEA report, “Methodologies for Assessing the Economic Consequences of Nuclear Reactor Accidents,” April 2000, discusses importance of qualitative considerations of factors

Federal and International Agencies *cont.*



Scenarios Involving Qualitative Consideration

- Scenario A:
  - Benefits cannot be quantified and are presented only qualitatively
  - Costs are quantified
  - Past application to security-related and nonpower reactor regulatory actions
- Scenario B:
  - Some benefits can be quantified, others qualitatively considered
  - Costs are quantified
  - The net benefit of the quantitative analysis is **positive**

Scenarios Involving Qualitative Considerations

- Scenario C:
  - Some benefits can be quantified, others qualitatively considered
  - Costs quantified
  - The net benefit of the quantitative analysis is **negative;** qualitative considerations support the regulatory action
- Scenario D:
  - Some benefits can be quantified, others qualitatively considered
  - Costs are quantified
  - The staff identifies the qualitatively considered factors, but does not include them when forming a recommendation

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Conclusions

- NRC guidance notes that the staff should make reasonable efforts to quantify costs and benefits.
- Both quantitative and qualitative consideration of factors is important to understanding the overall impacts of a regulatory action
- Aligned with other federal and international agencies' practices
- NRC's current framework for considering qualitative consideration of factors is sound
- Lack of specific guidance has led to a perception that qualitative consideration of factors can be arbitrarily weighted against quantitative consideration of factors
- The staff finds that developing guidance to clarify the potential tools available would enhance the transparency and consistency of the regulatory process

Staff's Proposal

- Update cost-benefit guidance to include a set of methods that could be used for the qualitative consideration of factors within a cost-benefit analysis for regulatory analyses and backfit analyses
- The revised guidance would include information regarding how and when to apply the methods and how the results would be used to inform the decisions.
- Methods should be consistent with the PRA policy statement as characterized in Reg. Guide 1.174
- Regulatory analyses and backfit analyses decision rationale should include
  - Describing qualitative evaluation of factors
  - Significance of each factor
  - How each factor contributes to the integrated decisionmaking process
- If Commission approved, guidance would be developed as part of overall plan for updating cost-benefit guidance
  - Staff would plan to have ACRS interactions/review

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References

- SECY-14-0087 available at ML14127A458
- EO 12866, 58 FR 51735 (October 4, 1993) and http://www.whitehouse.gov/omb/inforeg_riaguide/
- May 28, 2014 Public Meeting Summary available at ML14156A024
- NRC policy statements available at http://www.nrc.gov/reading-rm/doc-collections/commission/policy/
- NUREG/BR-0184 available at ML050190193
- NUREG/BR-0058 available at ML042820192

References (cont'd)

- NUREG-1409 available at ML032230247
- NUREG-1530 available at ML063470485
- OMB Circular A-4, available at ML11231A834
- OIRA Regulatory Analysis Primer, http://www.whitehouse.gov/sites/default/files/omb/inforeg/regpol/circular-a-4_regulatory-impact-analysis-a-primer.pdf
- Regulatory Guide 1.174 available at ML100910006
- OECD/NEA April 2000 report http://www.oecd-ilibrary.org/nuclear-energy/methodologies-for-assessing-the-economic-consequences-of-nuclear-reactor-accidents_9789264181472-en

References (cont'd)

- SECYs available at http://www.nrc.gov/reading-rm/doc-collections/commission/ or in ADAMS
- SECY-77-388A available at ML12234B122
- SECY-12-0110 available at ML12173A478
- SECY-12-0157 available at ML12345A030
- SRM-SECY-12-0110 available at ML13079A055
- SRM-SECY-12-0157 available at ML13078A017
- SRM-SECY-13-0132 available at ML14139A104

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Protecting People and the Environment

Generic Letter Monitoring of Neutron-Absorbing Materials in Spent Fuel Pools

Scott Krepel – Division of Safety Systems
Matthew Yoder – Division of Engineering
Office of Nuclear Reactor Regulation

ACRS Full Committee Meeting

September 4, 2014

NRC Opening Remarks

Timothy McGinty – Division Director
Office of Nuclear Reactor Regulation
Division of Safety Systems

ACRS Full Committee Meeting

September 4, 2014

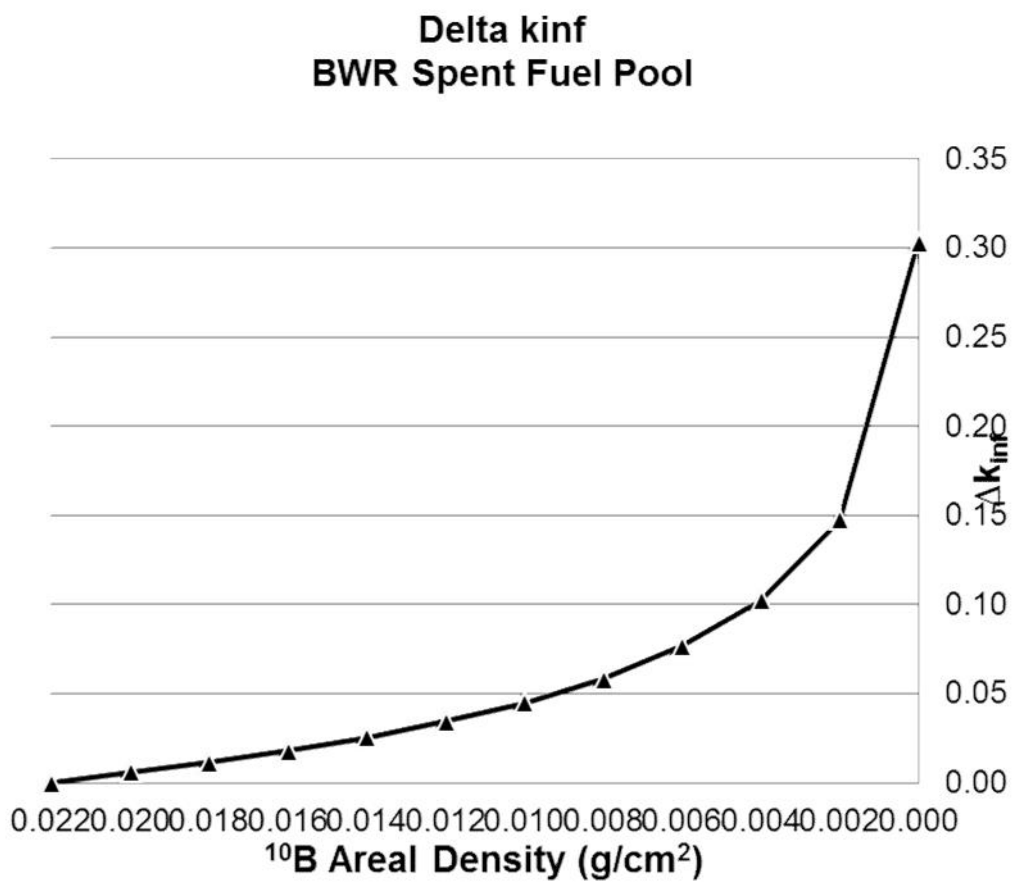
Regulatory Basis

- Regulatory criteria to prevent the occurrence of inadvertent criticality events in the SFP
  - 10 CFR 50.68
  - GDC 62

- Licensees submit nuclear criticality safety analyses to demonstrate that the criteria are met

Reactivity Effect

- Typically SFP NCS Analysis have ~ 0.005 Δk to regulatory limit.
- Compliance/Safety
  - Initially a compliance issue.
  - As degradation progresses it becomes a safety issue
  - As degradation progresses response to events becomes more of a concern
- Key is knowing condition of NAM



Minimum Critical Volume

Shika 1 ICE Core

- Control Rods
  - 89 Total
  - 3 Moved
- Displacement
  - A: 16 steps
  - B: 20 steps
  - C: 08 steps
  - The rest: 0
- Core periphery
  - Leakage
- Local Condition of NAM

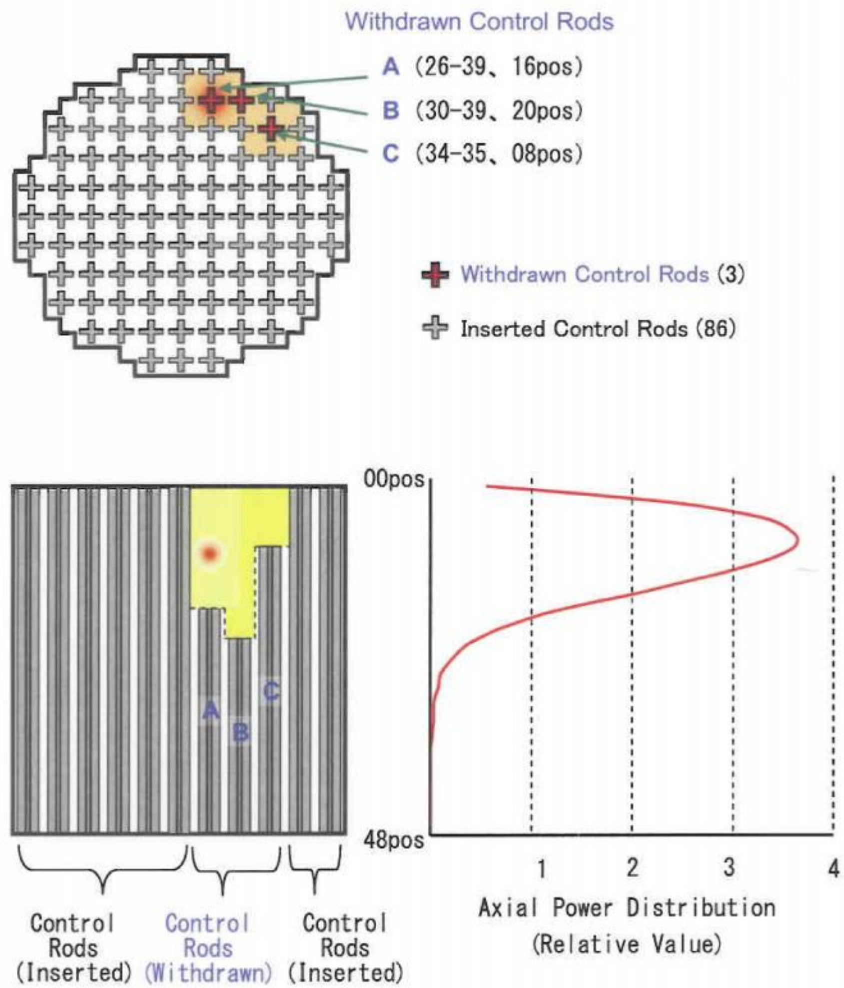
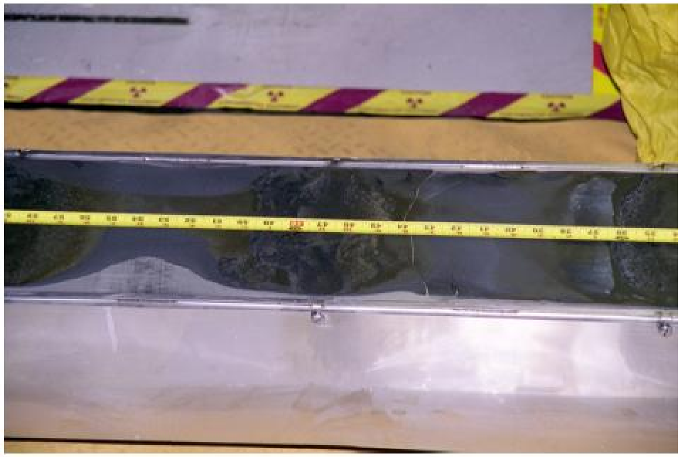
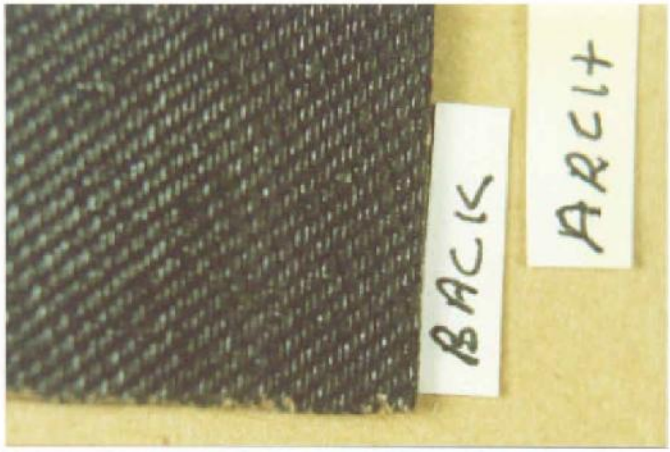


Figure 2 Power Distribution of the Core

Materials

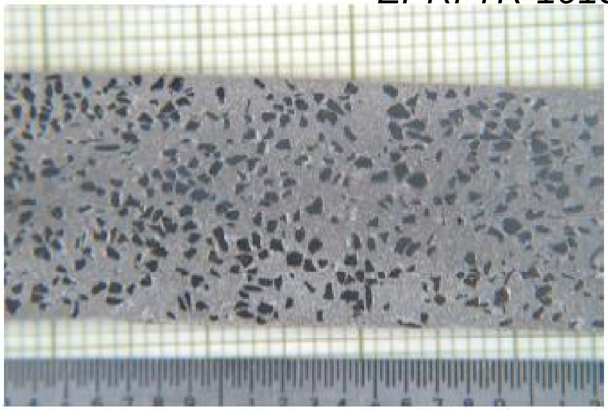


Boraflex with scallop
EPRI TR-1003414



Carborundum sheet
EPRI TR-1013721

Boral with blisters
EPRI TR-1013721



Al359/23% B_4C large-grain MMC
EPRI TR-1013721

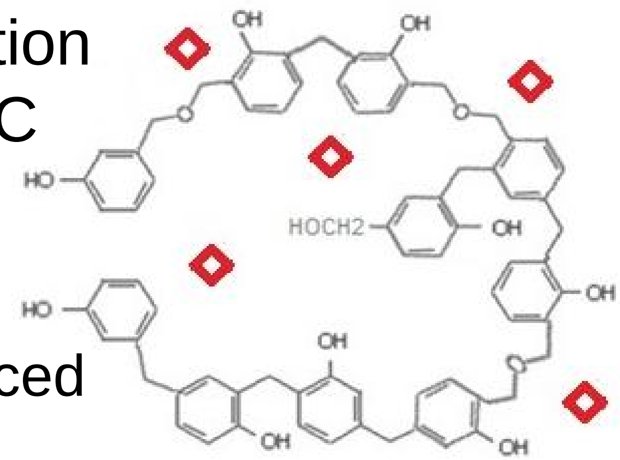
Phenolic Resins

- B_4C particles encased in a phenolic resin matrix

- Polymer backbone degraded by irradiation and the pool environment, releasing B_4C particles

  - Modes and rates of degradation influenced by the specific panel environment

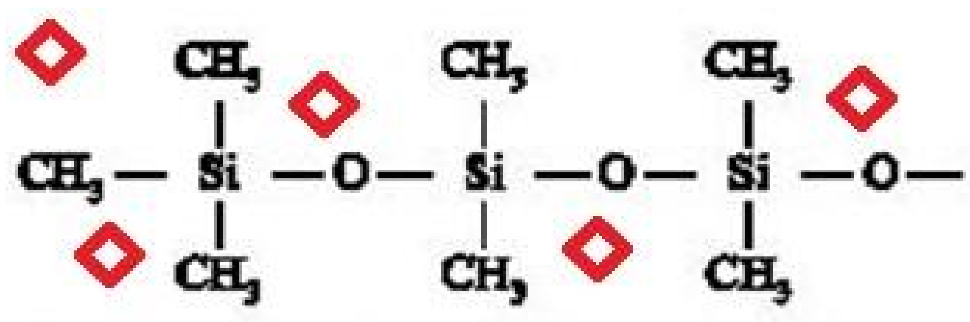
  - Ability of degraded matrix to retain B_4C not well known



- Limited ability to predict the loss of B_4C

Boraflex

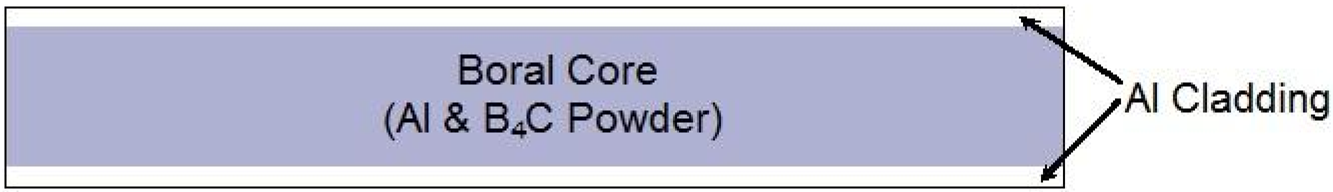
- B_4C particles encased in a silicone matrix



- Multi-step degradation
  1. γ → cross-linking and shrinkage, which leads to gaps
  2. γ → conversion of silicone polymer backbone into slightly soluble silica particles
  3. Pool flow → dissolution of silica particles, release of B_4C

Boral

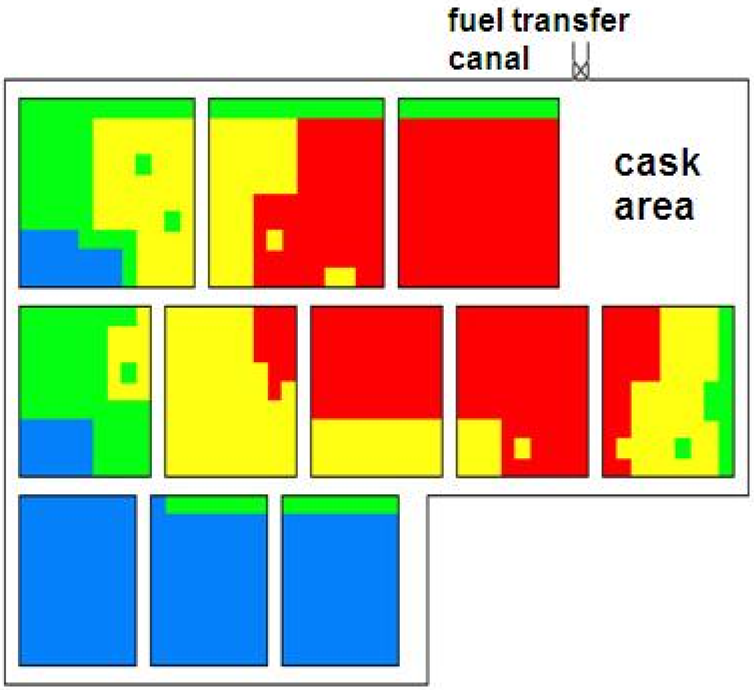
- Al-B_4C cermet with Al cladding



- Blisters form due to gas formation under the cladding
- Older material with unvented sheathing exhibited large bulges
- Blister presence, severity, and location vary widely based on specific material and pool environment
- Testing to date shows no loss of absorber material
- However, blisters displace moderator, resulting in an impact to criticality

BADGER uncertainties

- A typical BADGER campaign tests ~30-60 panels out of a ~3000-4000 panels in a pool
  - RACKLIFE is used to inform BADGER panel selection for Boraflex
  - No predictive method exists for other neutron absorbers



T.C. Haley, 2012

Operating Experience

- Information Notices (INs)
  - Documented operating experience events
- Other
  - Issues resolved through LARs/commitments
  - Improper uses of 10 CFR 50.59
  - Non-cited violations
  - Issues entered into licensee's Corrective Action Program

Prior NRC Actions

- Generic Letter (GL) 96-04
  - Requested evaluation of Boraflex degradation
- Technical Letter Reports
  - Technical evaluations by Research office
- Update to Existing Guidance
  - Generic Aging Lessons Learned Report
  - Interim Staff Guidance on criticality analyses

SFP Management Spreadsheet

- Lists how each pool meets the subcriticality requirements
- References the applicable licensing document
- Latest Update: March 2014
    - Carborundum/Tetrabor: 4 SFPs
    - Boraflex: 10-14 SFPs
    - Boral: 53 SFPs
    - Other: 13-16 SFPs

Generic Letter: Purpose

Request information demonstrating that credited neutron-absorbing materials in the spent fuel pool are in compliance with the current licensing and design basis, as well as applicable regulatory requirements

Determine if additional regulatory action is required

Information Requested

1. Material properties and configuration

2. Surveillance program methodologies

3. Surveillance program frequencies

4. Criticality analysis modeling of the material and degraded material

5. Design basis event considerations

Response to Public Comments

- Subcriticality margin that forms part of a plant's licensing basis should not be credited to address issues not considered when the licensing basis was approved (e.g., no double-counting of margin)

- Recent operating experience shows that effective monitoring is necessary to ensure compliance

Summary

- Management of degradation of neutron-absorbing materials is a compliance and safety issue
- Recent events have raised concerns that current monitoring may not be adequate
- Therefore, the NRC is requesting information that licensees should have readily available

Industry View on Neutron Absorbers

Kristopher Cummings

Sr. Project Manager, Used Fuel Programs

Sept 4th, 2014 • Rockville, MD

Topics of Discussion

- Types of Neutron Absorbers in Use
- Is this a Safety Concern?
- Ongoing Industry Efforts
- Alternative Proposal
- Summary/Conclusions

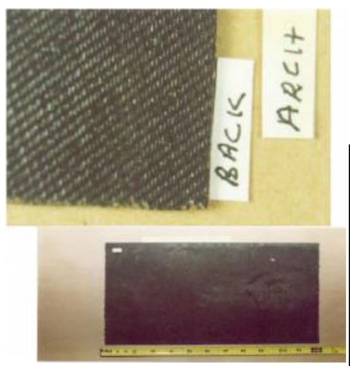
Types of Neutron Absorbers in Use

Boraflex

- B_4C particles bound in a silicone rubber matrix
- Degradation mechanism is based on a threshold gamma dose and exposure to pool water (especially flowing water)
- Degradation causes dissolution of silicia into pool water and loss of B_4C from matrix

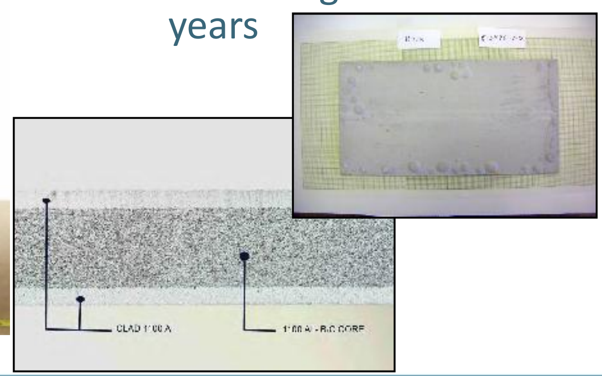
Carborundum

- B_4C particles in a Phenolic Resin
- Aging/Degradation issues:
  - Loss of weight
  - Off-gassing from pool water exposure
- Plate type is extremely thick (0.25") and black (0.1 g $^{10}B/cm^2$)



Boral

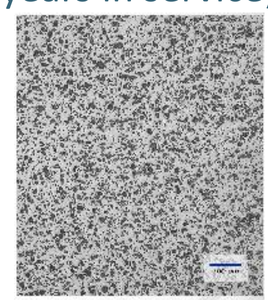
- Aluminum Boron Carbide Cerment
- Aging/Degradation issues:
  - Blistering (seperation of Al clad from core material)
  - Pitting (small, localized)
- No observed loss or redistribution of B_4C
- EPRI Boral database contains data extending over 25 years



Metal-matrix Composites

(Metamic, Alcan, Boralcan)

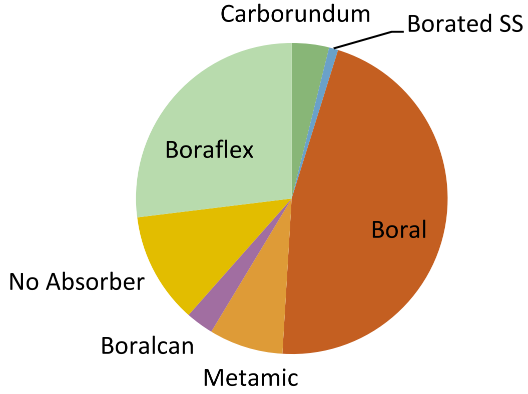
- Fully dense (no porosity)
- Aging/Degradation issues are:
  - Pitting (small, localized)
  - General Corrosion
- No blistering possible (no Al clad)
- No observed loss or redistribution of B_4C (~10 years in service)



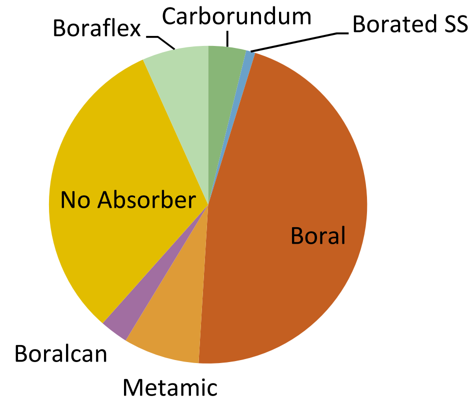
Types of Neutron Absorbers in Use

- **Carborundum/Tetrabor**
  - All plants credit some amount of the neutron absorber and have monitoring programs in place.
- **Boraflex**
  - Majority of plants have discontinued credit of neutron absorber.
  - Remainder of plants have LARs for inserts, LARs to remove/take partial credit, or monitor via in-situ testing.
- **Boral**
  - Over 50% of the plants have coupon testing programs
  - Those plants without coupons are adding in-situ testing and/or monitoring fleet & industry results
- **Metamic/Boralcan**
  - All have coupon monitoring programs

Installed Neutron Absorber



Credited Neutron Absorber



Results based on a partial survey of the industry

Is this a Safety Issue?

- Non-Metallic Absorbers (Boraflex, Carborundum)
  - Degradation has largely been addressed by:
    - elimination of absorber credit
    - installation of new neutron absorber inserts
    - Monitoring/reanalysis with conservative treatment and prediction of neutron absorber presence

- Metallic Absorbers (Boral, Metal-matrix)
  - Aging effects for metallic absorbers is a slow process (decades) that provides advance indication through coupon testing, in-situ measurements and pool chemistry.
  - Aging effects (pitting, general corrosion, localized loss of material) has a negligible effect on criticality (< 0.001 Δk).
  - Boral blistering, theoretically could have an impact (0.01 Δk) in flux-trap racks, in reality is a minimal localized effect (0.001 Δk). These effects are addressed in the licensee 10 CFR Part 50, Appendix B quality assurance program.

- Large loss of material (50-60%) is needed to overcome administrative margin (0.05 Δk)
- Significant amounts of independent reactivity hold-down is present in pools:
  - PWR Pools:
    - Soluble boron present in pool to offset unexpected conditions (approximately 2000ppm per Tech Spec = ~0.20 Δk)
  - BWR Pools:
    - Analysis based on maximum reactivity provides significant conservatism (> 0.10 Δk)
    - Regulatory administrative margin (0.05 Δk)

Ongoing Industry Efforts on Neutron Absorbers

- **EPRI Accelerated Boral Corrosion Testing :**
  - BWR & PWR Spent Fuel Pool Conditions
  - Five year test program
  - 192 coupons are placed in baths
  - Encapsulated and Un-encapsulated Coupons
  - Various fabrication processes
  - Tests are conducted at 195°F to simulate approximately >60 years of service life
  - First year results showed pitting, no blisters, no loss of areal density

EPRI Zion Comparative Analysis Project

- Perform a **comparative analysis** of
  - Surveillance sample coupon measurements
  - In-situ measurements
  - BORAL panel test measurements
- Opportunity to address concerns with comprehensive plant data
- Boral panels have been in use since 1993; plant shutdown in 1998
- Provide the technical bases that will permit the continued long-term use of Boral based on current surveillance practices

- **NEI 12-16**, "Guidance for Performing Criticality Analysis of Fuel Storage at Light Water Reactor Power Plants":
  - Includes a section on the appropriate monitoring program depending on material and availability of coupons
- Industry continues to share test results, operating experience through the **EPRI Neutron Absorbers Users Group** (NAUG)
- Potential **investigation into realistic estimate of reactivity effect of postulated aging effects or degradation** on criticality analysis (blistering, pitting, corrosion).
  - Help determine a threshold at which degradation has a negligible/non-negligible effect.

Alternative Proposal

- NEI has proposed the following alternative to the draft Generic Letter:
  - Allow licensees to commit to an acceptable neutron monitoring program (i.e., NEI 12-16)
  - Focus scope of Generic Letter on known susceptible materials (Boraflex, Carborundum/Tetrabor)
  - Exclude the following licensees:
    - No credited absorber in the criticality analysis
    - Already undergone license renewal (have an existing aging management program)
    - Have an approved program in the last five years through a license amendment request.
  - For remainder of plants, remove request for detailed information in Appendix A.

Summary/Conclusions

- Industry has responded to operating experience and NRC notifications to address significant neutron absorber degradation issues. (Boraflex, Carborundum)
- With 35 years of in-pool exposure, Boral continues to provide the same level of neutron absorption capability as when it was installed.
- Newer metal-matrix materials are expected to provide a similar or better level of performance compared to Boral (blistering eliminated).
- Existing monitoring programs and industry research will provide additional information to ensure that any degradation processes are observed and responded to prior to becoming a safety or compliance issue.
- NEI proposed alternative is a risk-informed approach that focuses industry and regulatory attention on those materials that are most susceptible to aging effects and potential degradation mechanisms.

Fermi 3 COLA
Presentation to Full ACRS Committee

Presentation Overview

DTE Energy

- Background
  - Overview of the Design and Departure
- Site Characteristics and Applicability
  - Review Flooding and Seismic Evaluations
- Fukushima Near Term Task Force Recommendations

  4.2 Mitigating Strategies for Beyond-Design-Basis External Event

  7.1 Reliable Spent Fuel Pool Instrumentation

  9.3 Emergency Preparedness

Background - Fermi 3 Implements Standard ESBWR Design

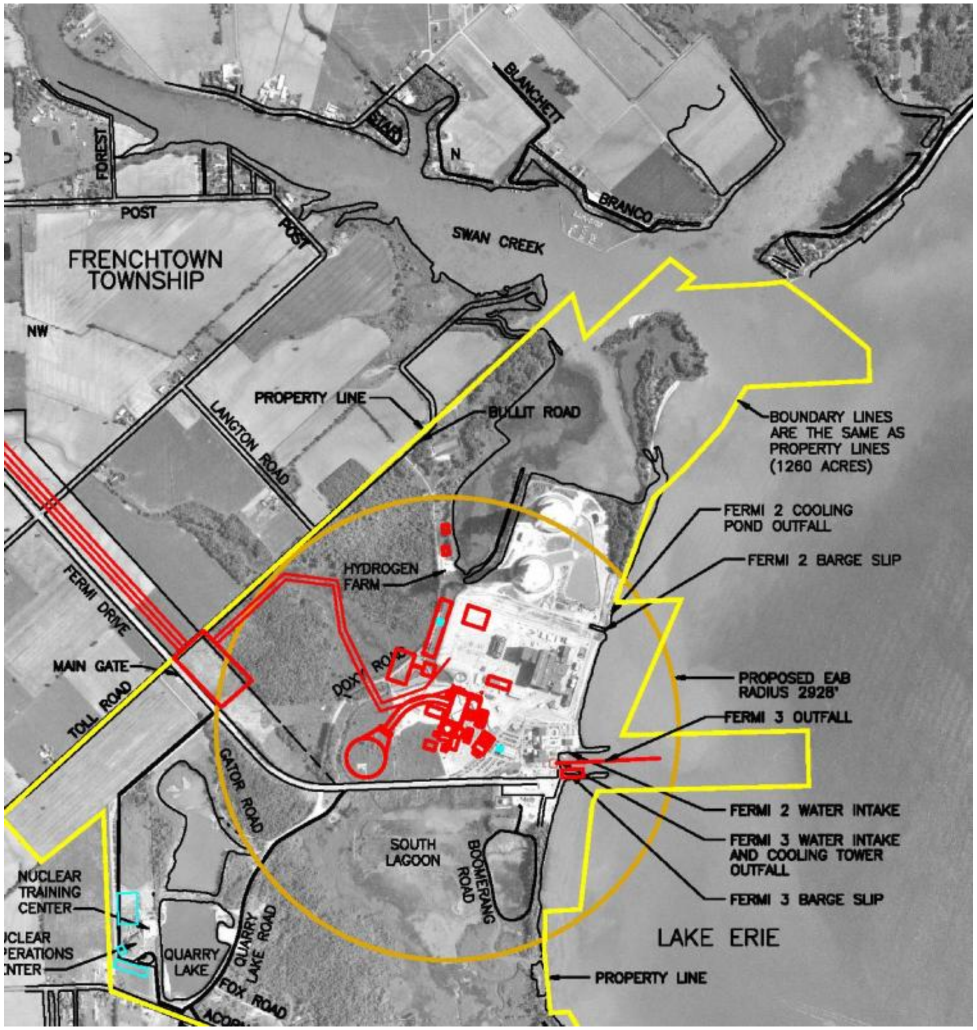
Fermi 3 Implements Standard ESBWR Design

- ESBWR DCD Revision 10 Incorporated by reference
- The ESBWR is well suited for the Fermi 3 Site
- Supplements added where DCD requires additional information to address site-specific considerations
- One Departure from DCD to increase solid waste storage capacity in RadWaste Building

Site Characteristics - Flooding

Overview of Hydrology in Site Vicinity

- Located on western shore of Lake Erie
- Swan Creek runs along the north edge of the site. Swan Creek watershed is approximately 106 square miles
- The western basin of Lake Erie is relatively shallow
- Maximum probable flood level is below plant grade for Fermi 3 safety-related and RTNSS structures

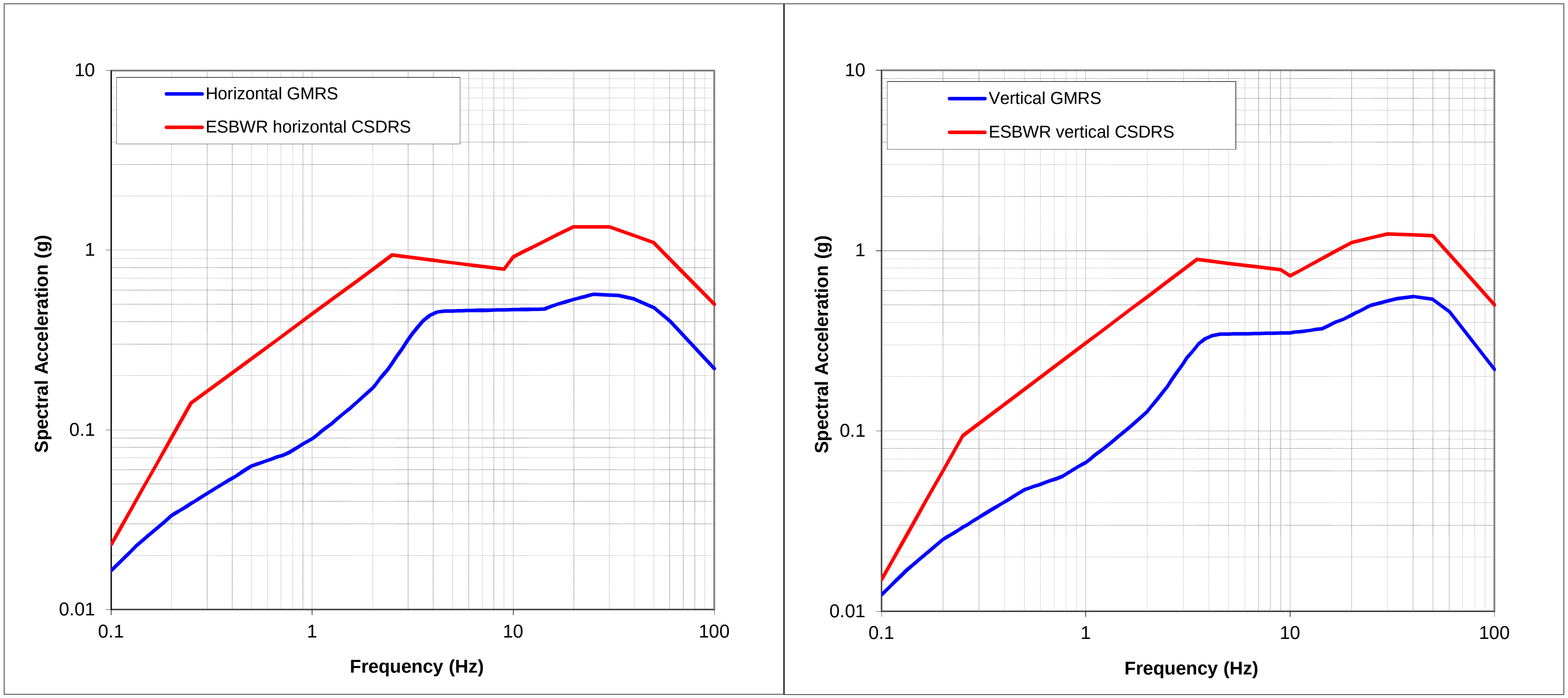


Site Characteristics - Seismic

- Fermi 3 Ground Motion Response Spectra (GMRS) was developed using current regulatory guidance
  - Used Central and Eastern United States Seismic Source Characterization (CEUS SSC) model (NUREG-2115)
  - Used EPRI 2004/2006 Ground Motion Models
  - Followed NUREG-2117 guidance to incorporate new information into seismic hazard model
- Fermi 3 GMRS, Foundation Input Response Spectra (FIRS), and resulting site-specific in-structure responses are well enveloped by the ESBWR standard plant design

Site Characteristics – Seismic
Fermi 3 is Bounded by ESBWR Design

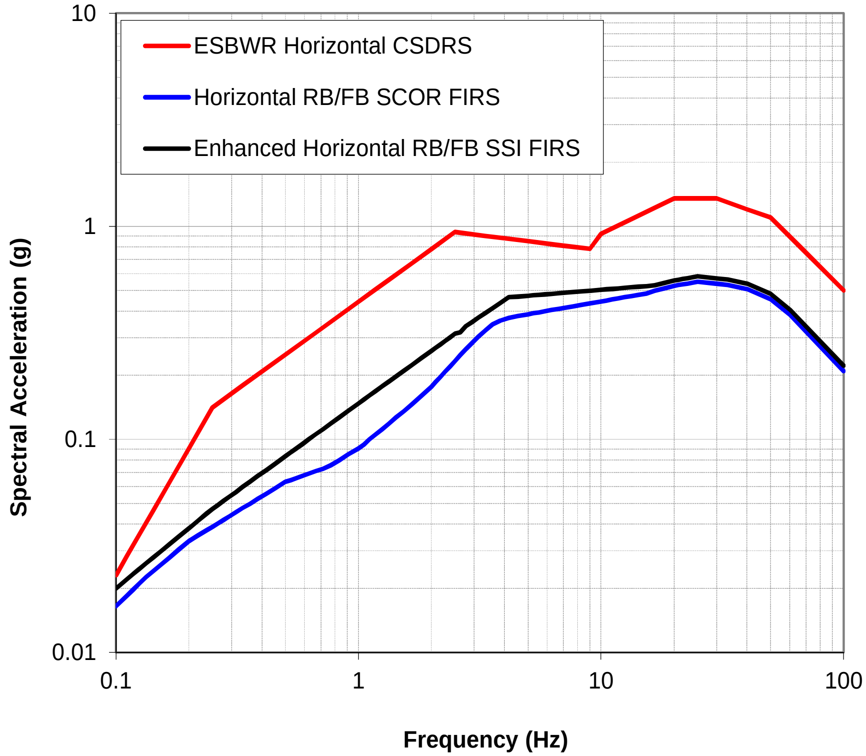
Fermi 3 GMRS compared to ESBWR CSDRS (5 percent damping)

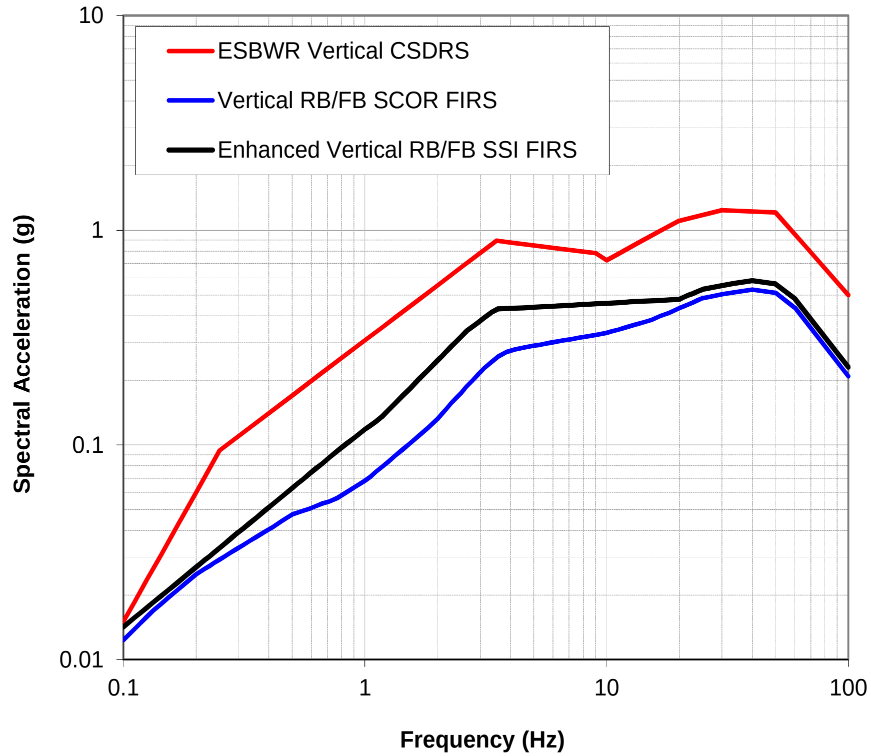


GMRS for Fermi 3 site is well enveloped by the ESBWR horizontal and vertical Certified Seismic Design Response Spectra (CSDRS)

Site Characteristics – Seismic
Fermi 3 is Bounded by ESBWR Design

Fermi 3 RB/FB FIRS compared to ESBWR CSDRS (5 percent damping)

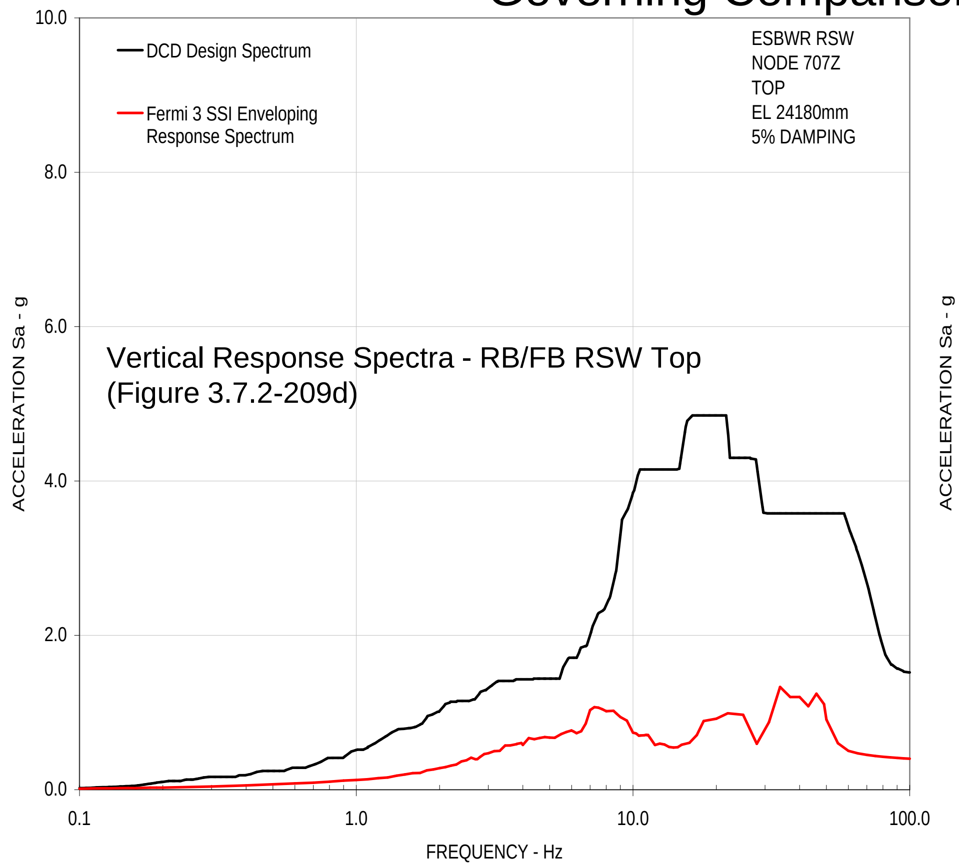


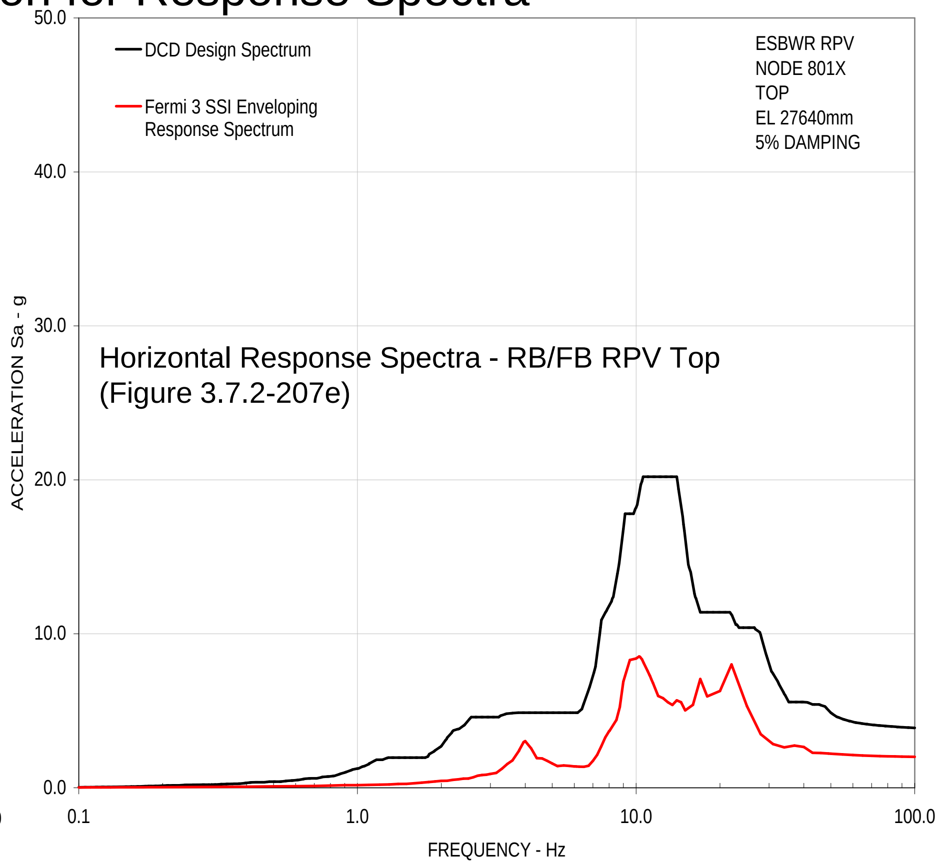


FIRS for Fermi 3 RB/FB, CB, and FWSC are well enveloped by the ESBWR horizontal and vertical CSDRS

Site Characteristics – Seismic
Fermi 3 is Bounded by ESBWR Design

Governing Comparison for Response Spectra





The Fermi 3 RB/FB is well enveloped by the ESBWR RB/FB standard plant design

Fermi 3 COLA
Presentation to Full ACRS Committee

Presentation Overview

Fukushima Near Term Task Force Recommendations

4.2 Mitigating Strategies for Beyond-Design-Basis External Event

7.1 Reliable Spent Fuel Pool Instrumentation

9.3 Emergency Preparedness

Recommendation 4.2 - Mitigating Strategies for Beyond Design Bases External Events

Fermi 3 satisfies the requirements applicable to the passive ESBWR design

- NRC Order EA-12-049, “Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events”
- JLD-ISG-2012-01, “Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events”
- NEI 12-06, “Diverse and Flexible Coping Strategies (FLEX) Implementation Guide”

Recommendation 4.2 - Mitigating Strategies for Beyond Design Bases External Events

- ESBWR passive design provides for coping during the initial 72 hours
- Time periods beyond 72 hours are addressed by supplementing installed plant equipment with on-site and off-site resources

Recommendation 7.1- Reliable Spent Fuel Pool Level Instrumentation

Fermi 3 satisfies the requirements applicable to the ESBWR design

- NRC Order EA-12-051, “Reliable Spent Fuel Pool Instrumentation”
- JLD-ISG-2012-03, “Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation”
- NEI 12-02, “Industry Guidance for Compliance with NRC Order EA-12-051, To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation”

Recommendation 9.3 - Emergency Preparedness

- Staffing and Communications Assessments will be performed in accordance NEI 12-01, "Guidance for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities"
    - Assessments completed at least two years prior to scheduled initial fuel load
    - Corrective Actions implemented one hundred eighty days prior to scheduled initial fuel load

Presentation to the ACRS Full Committee

Fermi Unit 3
COL Application Review

Site Characteristics

September 4, 2014

Site Characteristics

Presentation Outline

- **Overview of Flooding**
- **Overview of Seismic Evaluation**

- **Technical Staff**
  - RHM, Chief, Aida Rivera-Varona
  - RHM, Technical Review, Henry Jones
  - RHM, Technical Review, Joseph Giacinto
  - RGS, Chiefs, Diane Jackson and Rebecca Karas
  - RGS, Technical Reviewer, Sarah Tabatabai
  - SEB, Chief, Jim Xu
  - SEB, Technical Reviewer, Manas Chakravorty

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Section 2.4
Hydrology

Presented by:
Henry Jones

Summary of FSAR Section 2.4

- **EF3 COL Item 2.0-13-A – Flood**
  - Staff reviewed: (1) Historical flooding, (2) Individual types of flood-producing phenomena, (3) Combinations of flood-producing phenomena, (4) Factors affecting potential runoff and (5) Local intense precipitation.
  - Staff verified that runoff from local intense precipitation (584.8 ft NAVD88) would not exceed the site grade plant parameter of 589.3 ft.

- **EF3 COL Item 2.0-14-A - Probable maximum flood on streams and rivers effecting site.**
  - Staff verified that the flooding from streams and rivers (579.4 ft NAVD88) would not exceed the site grade plant parameter of 589.3 ft.

- **EF3 COL Item 2.0-16-A - Probable Maximum Surge and Seiche Flooding**
  - The staff calculated a still water level of 585.4 ft NAVD88. The maximum elevation that waves would break is 587.7 ft at the toe of the berm with a wave runup to 588.4 ft. These elevations are 1.6 ft and 0.9 ft below the elevation of the Fermi 3 safety structures (589.3 ft), respectively.
  - The open water of Lake Erie "results in a natural period of oscillation (29-124 s) of the flooded area that is much greater than that of the incident shallow-water storm waves (11 s) – no seiche.

Summary of FSAR Section 2.4

- **EF3 COL Item 2.0-17-A - Probable Maximum Tsunami Hazards**
  - Based on the history of the area and geological characteristics, the staff verified that local seismic disturbances would result only in minor excitations in the lake. No tsunami has been recorded in Lake Erie.

- **EF3 COL Item 2.0-23-A - Groundwater**
  - Operations and safety-related systems do not rely on dewatering.
  - The DCD's requires the(maximum) groundwater level to be at least 2 ft below the Fermi 3 plant grade. The historical high groundwater level is 12.7 ft below the planned plant grade. The PMF elevation of 584.4 ft NAVD 88 may allow onsite groundwater levels to reach 4.4 ft below the planned plant grade.

- **EF3 COL Item 2.0-24-A - Accidental Releases of Liquid Effluents in Ground and Surface Waters**
  - Verified radionuclide release simulations were adequately conservative.
  - Confirmed radionuclide levels would be below required levels at fictitious (well and Lake Erie) receptors.

Section 2.4
Hydrology

Questions

United States Nuclear Regulatory Commission
Protecting People and the Environment

Section 2.5.2
Vibratory Ground Motion

Presented by:
Sarah Tabatabai

Section 2.5.2
Vibratory Ground Motion

Overview of Staff Review

- COL information item EF3 COL 2.0-27A (Vibratory Ground Motion): Addresses the provision for site-specific information related to the vibratory ground motion aspects of the site including: seismicity, geologic and tectonic characteristics, the correlation of earthquake activity with seismic sources, a probabilistic seismic hazard analysis, seismic wave transmission characteristics, and site-specific GMRS.
- Applicant’s response to RAI 01.05-1, which addressed the Fukushima Recommendation 2.1 (R2.1) seismic hazard reevaluation

Background Related to the R2.1 Seismic Hazard Reevaluation

- Fermi 3 COL FSAR Section 2.5.2 Ground Motion Response Spectra (GMRS) was originally based on an updated EPRI-SOG (1986) seismic source model and the EPRI (2004, 2006) Ground Motion Model.
- NRC issued RAI 01.05-1 in May, 2012, which addressed R2.1 of the Fukushima Near Term Task Force:
  a) Evaluate the potential impacts of the CEUS-SSC model (NUREG-2115) on the seismic hazard
  b) Modify the site-specific GMRS and Foundation Input Response Spectrum (FIRS) if it's determined that changes are necessary given the evaluation performed in part a) above

Background Related to the R2.1 Seismic Hazard Reevaluation (Continued)

- In response to RAI 01.05-1, the applicant made major revisions to FSAR Section 2.5.2, which included an updated earthquake catalog, probabilistic seismic hazard analysis (PSHA), site response analysis, and GMRS reflecting the use of the CEUS-SSC model.
- The staff's review of the applicant's RAI response is detailed in SER Section 2.5.2

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Staff Evaluation and Additional Staff Confirmation

- Staff developed a supplementary earthquake catalog, which confirmed that the applicant's updated earthquake catalog adequately characterizes the local and regional seismicity through 2012
- Staff's confirmatory PSHA results are almost identical to the applicant's PSHA results for the distributed seismicity sources
- Staff's confirmatory site response results are very similar to the applicant's results
- Additional staff confirmation performed after SER completion involved developing a GMRS using the staff's confirmatory PSHA results (complete model) and site response results along with the EPRI (2013) ground motion model (GMM)

Section 2.5.2
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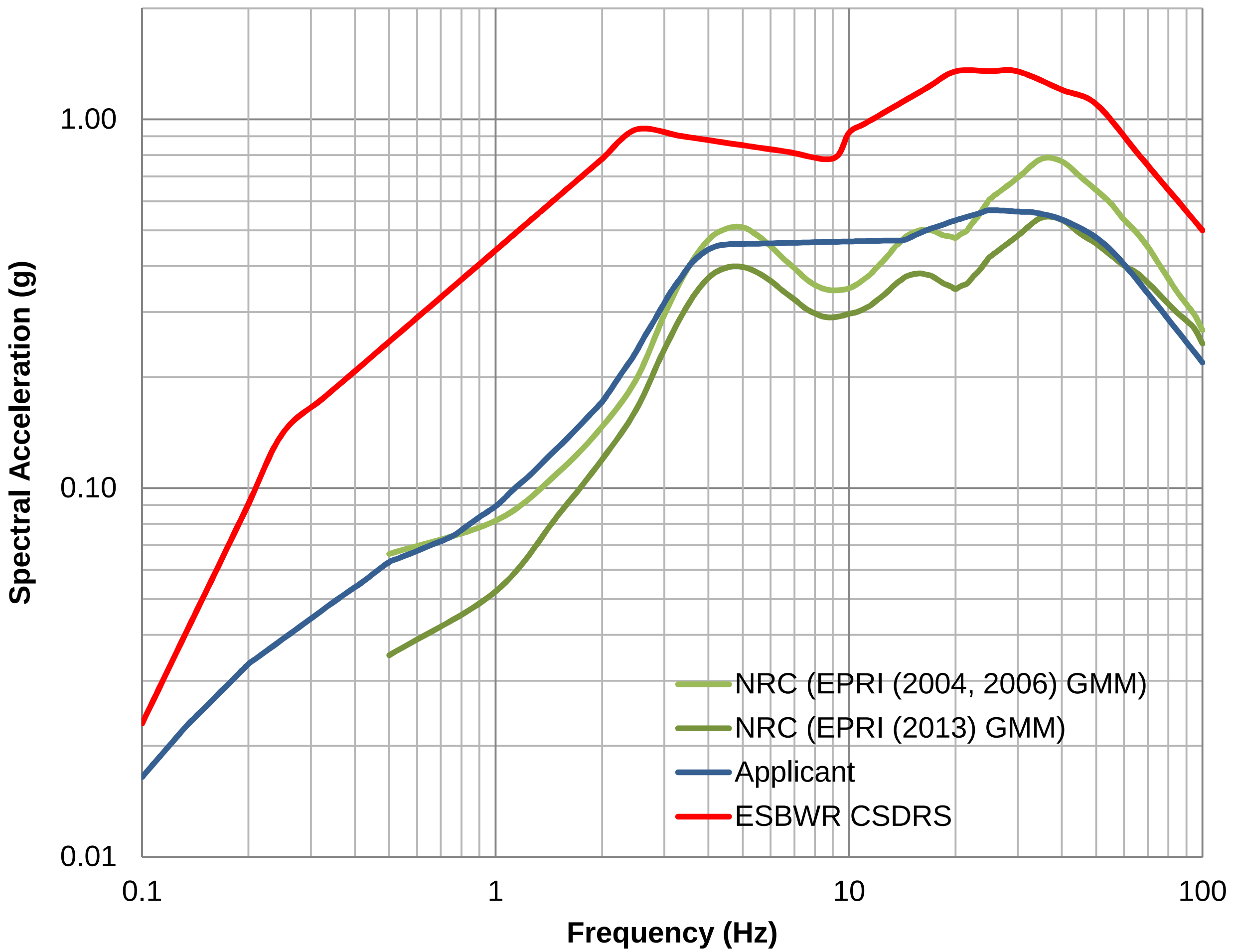
Additional Staff Confirmation

Ground Motion Response Spectra



Staff Conclusions

- Applicant has provided sufficient information to satisfy the relevant NRC regulations, the guidance in Section 2.5.2 of NUREG-0800, and applicant NRC regulatory guides
- Applicant has adequately addressed COL Item EF3 2.0-27-A related to vibratory ground motion.
- Applicant has adequately addressed the R2.1 RAI (RAI 01.05-1)

Section 2.5.2
Vibratory Ground Motion

Questions

Section 3.7, "Seismic Design," and Section 3.8, "Seismic Category I Structures"

Presented by:
Manas Chakravorty

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Section 3.7, "Seismic Design," and Section 3.8, "Seismic Category I Structures"

Overview

- Fermi FSAR incorporates ESBWR DCD Sections 3.7 and 3.8 by reference
- Site-specific FIRS are bounded by the CSDRS
- Fermi performed site-specific SSI analyses to address DCD backfill requirements and partial rock embedment effect
- Site-specific seismic demands for RB/FB and CB are bounded by standard plant design, including sensitivity analyses with backfill and no-backfill

Section 3.7, “Seismic Design,” and
Section 3.8, “Seismic Category I Structures”

Conclusions

- Applicant incorporated ESBWR DCD seismic design of Category I structures by reference with supplemental Information to address partial embedment of the RB/FB and CB in the rock and DCD backfill requirement
- Staff reviewed and determined that Supplemental Information for site-specific SSI is adequate
- Staff concludes that the applicant has provided sufficient information to meet relevant ESBWR DCD requirements and applicable NRC regulations

Section 3.7, "Seismic Design," and Section 3.8, "Seismic Category I Structures"

Questions

Section 3.7, “Seismic Design,” and Section 3.8, “Seismic Category I Structures”

Acronyms:

DCD	Design Control Document
RB/FB	Reactor/Fuel Building
CB	Control Building
FWSC	Fire water Service Complex
CSDRS	Certified Seismic Design Response Spectra
FIRS	Foundation Input Response Spectra
PBSRS	Performance Based Surface Response Spectra
SSI	Soil Structure Interaction
SSSI	Structure-Soil-Structure Interaction
LB/UB/BE	Lower Bound/Upper Bound/Best Estimate
LR/IR/UR	Lower Range/Intermediate Range/Upper Range
SASSI	Computer Code for SSI analysis
MSM	Modified Subtraction Method
DM	Direct Method

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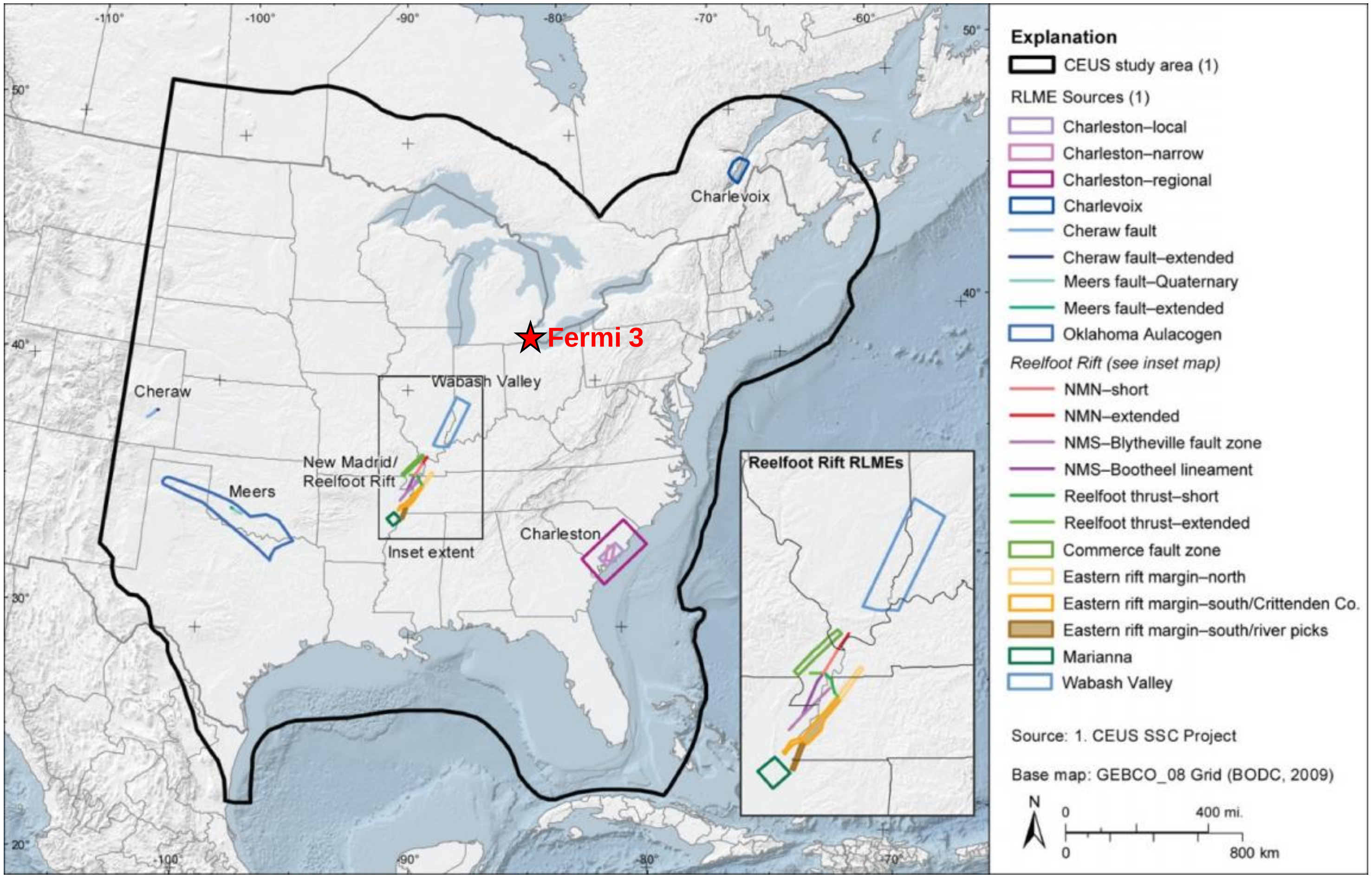
Backup Slides

Background Related to the R2.1 Seismic Hazard Reevaluation (Continued)



Repeated Large Magnitude Earthquake (RLME) sources are defined as having had two or more earthquakes with **M** ≥ 6.5.

CEUS-SSC Model Summary (Continued)

Mmax zones are based on average or “default” characteristics that are representative of large areas of the CEUS and are based on historical seismicity and broad-scale geologic and tectonic data

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CEUS-SSC Model Summary (Continued)

Seismotectonic zones are based on historical seismicity and regional-scale geologic and tectonic data to characterize seismic sources zones at a finer scale than the Mmax zones model.

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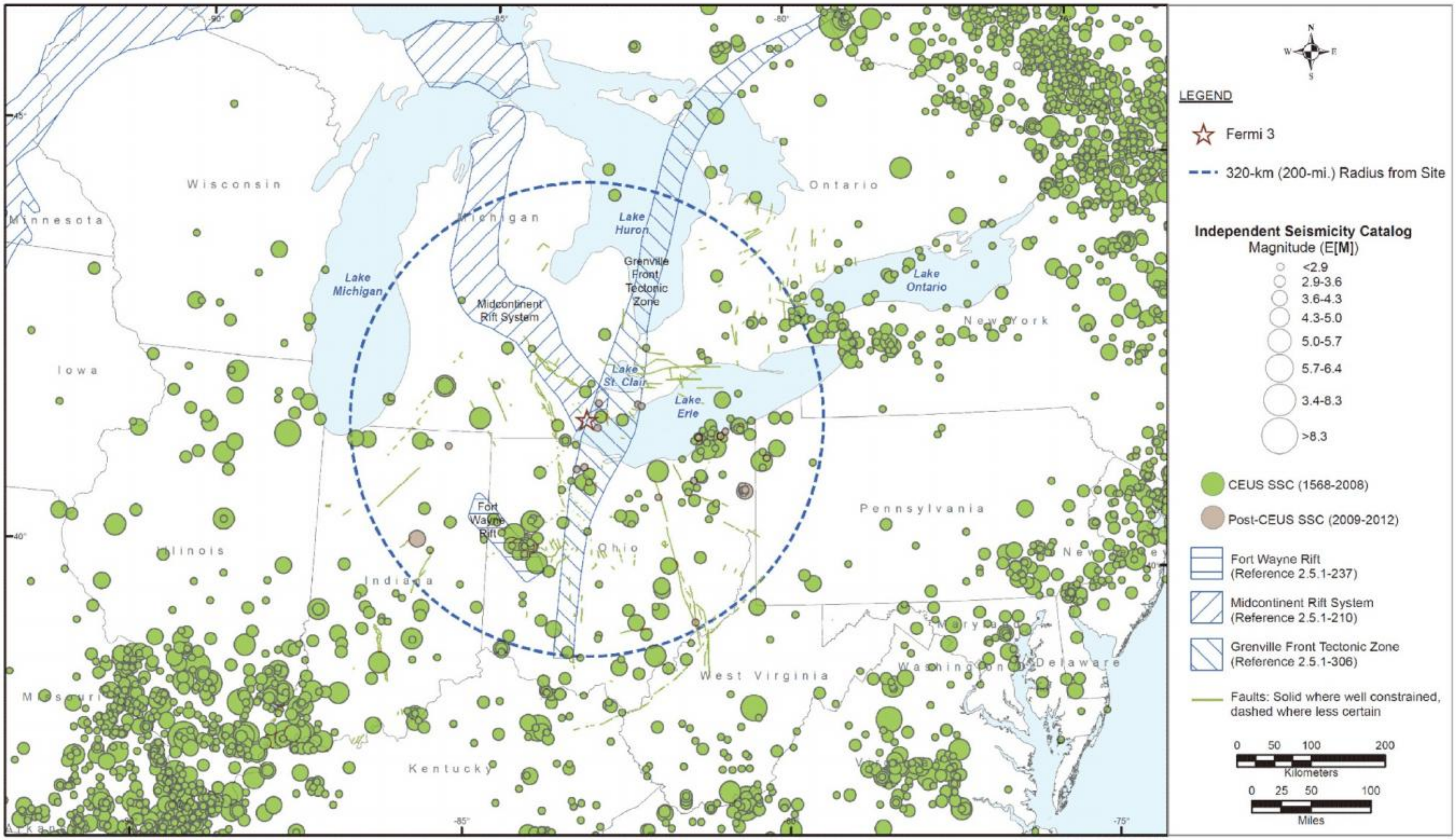
Staff Evaluation

Earthquake Catalog



Source: FSAR Figure 2.5.2-202

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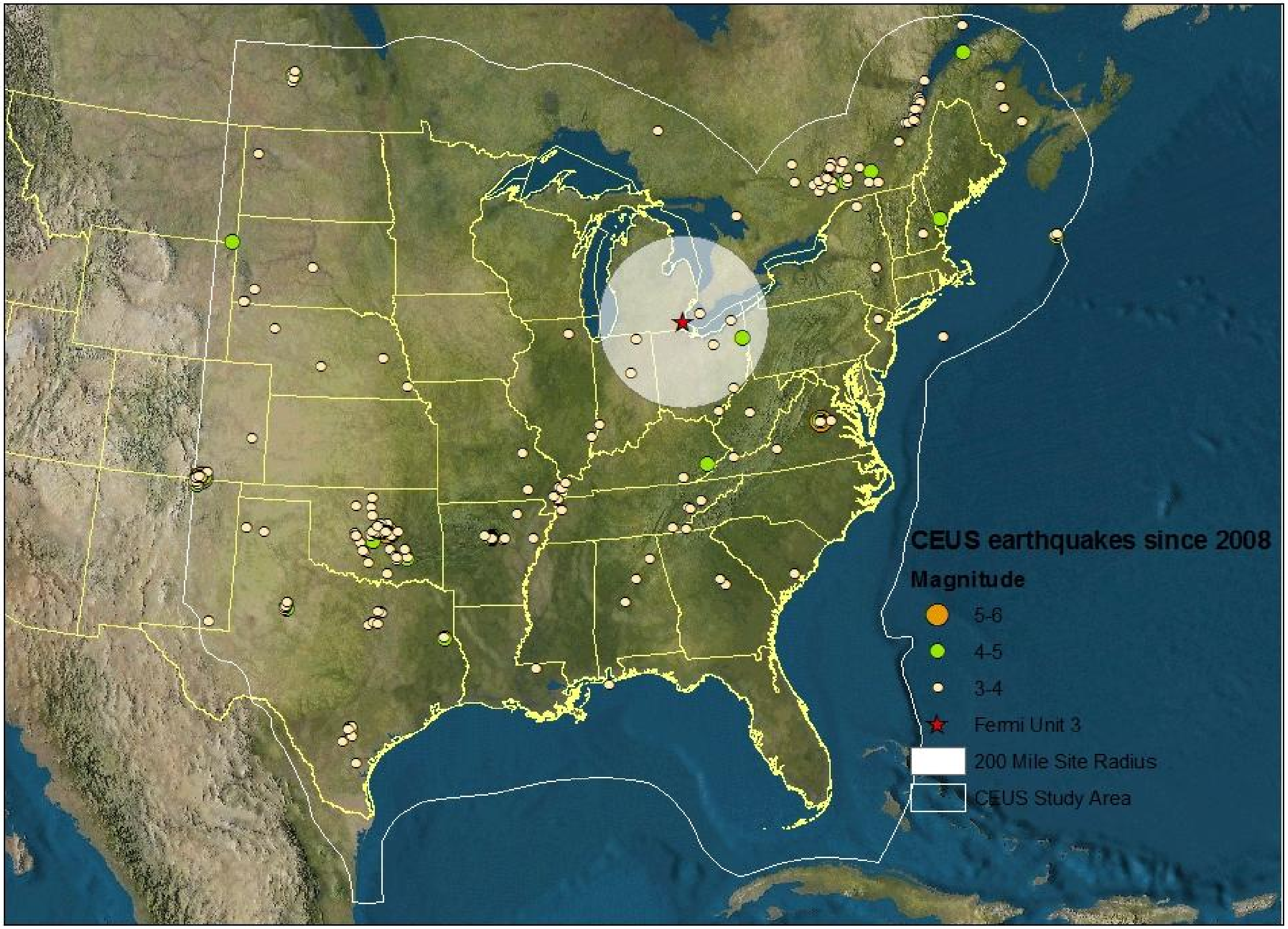
Staff Evaluation (Continued)

Earthquake Catalog



Source: FSER Figure 2.5.2-8 (Developed from the ANSS Earthquake Catalog)

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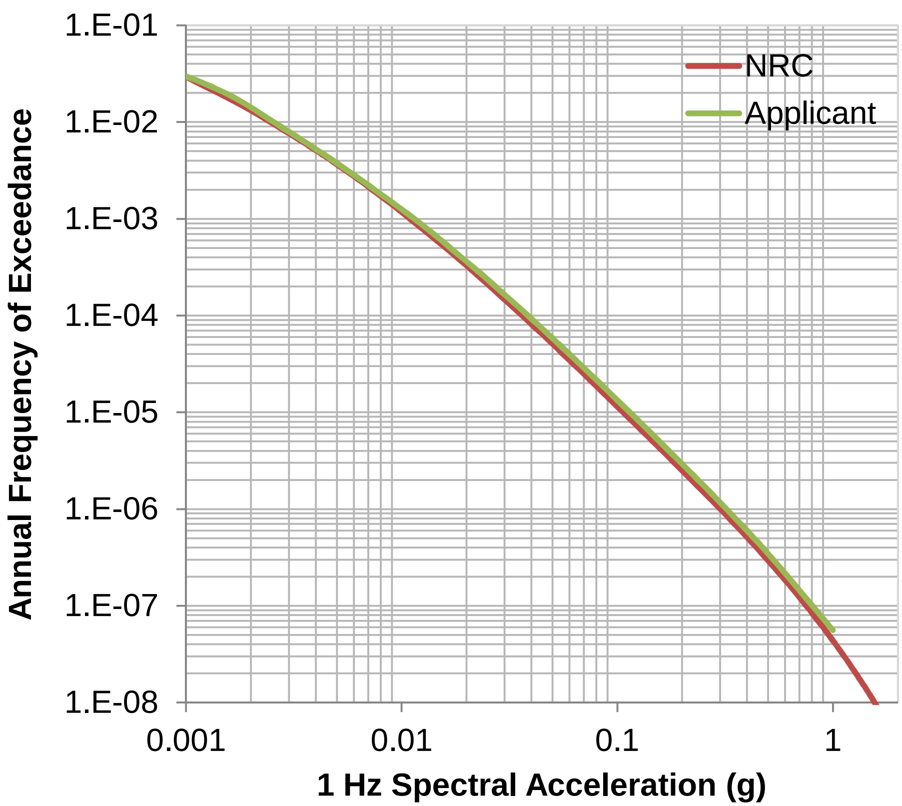
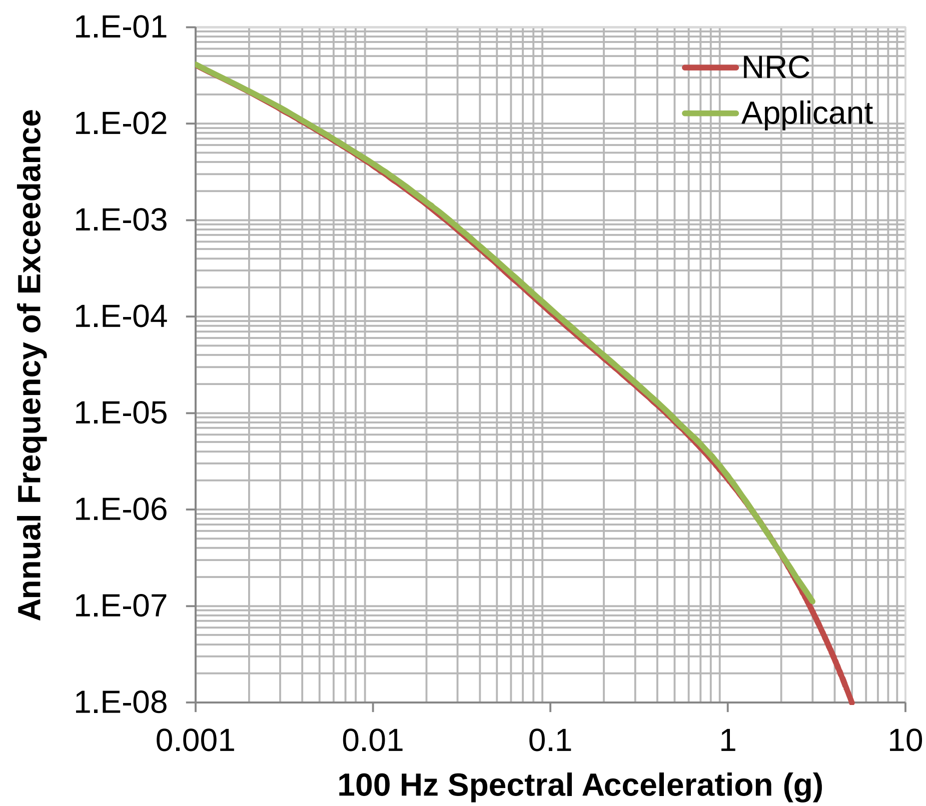
Vibratory Ground Motion

Staff Evaluation (Continued)

PSHA Confirmatory Analysis





Source: FSER Figures 2.5.2-9 and 2.5.2-11

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Staff Evaluation (Continued)

Site Response Confirmatory Analysis

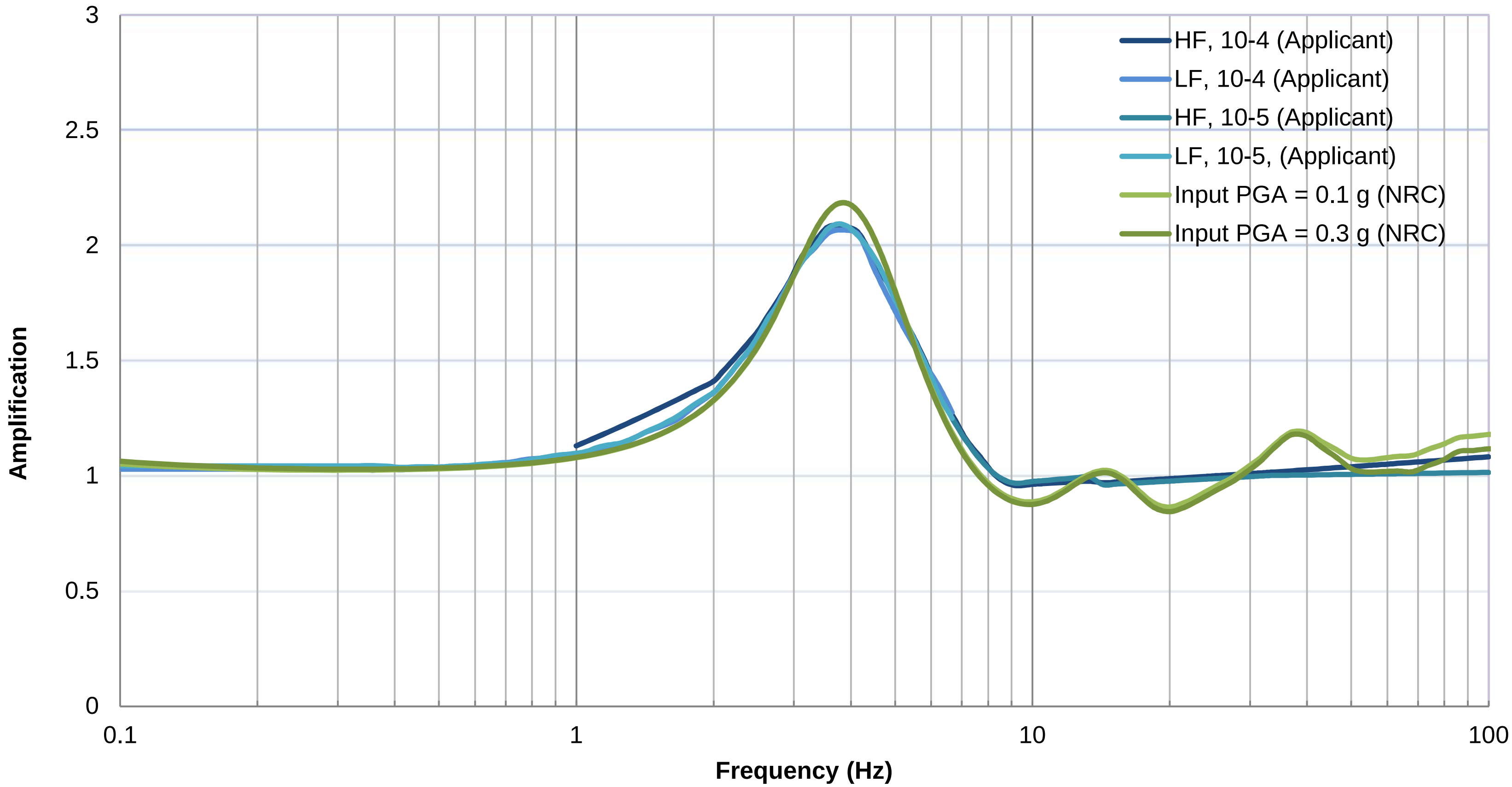

Figure developed from Applicant’s results provided in SER Figure 2.5.2-12 and the Staff’s results shown in SER Figure 2.5.2-13 (corresponding to a Q_s=40)

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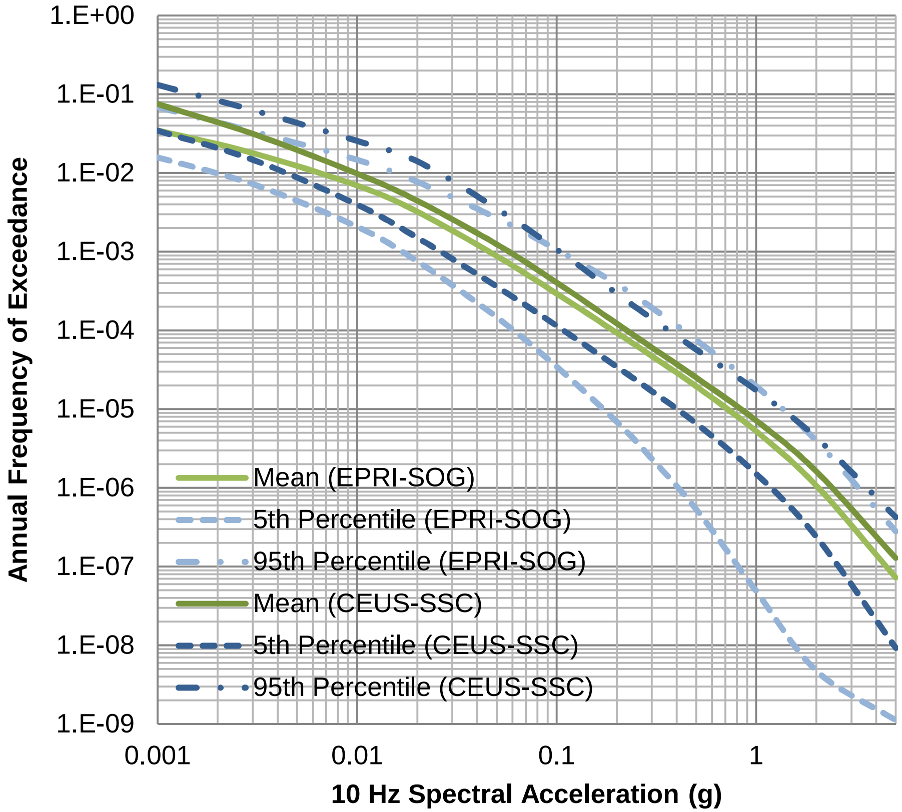
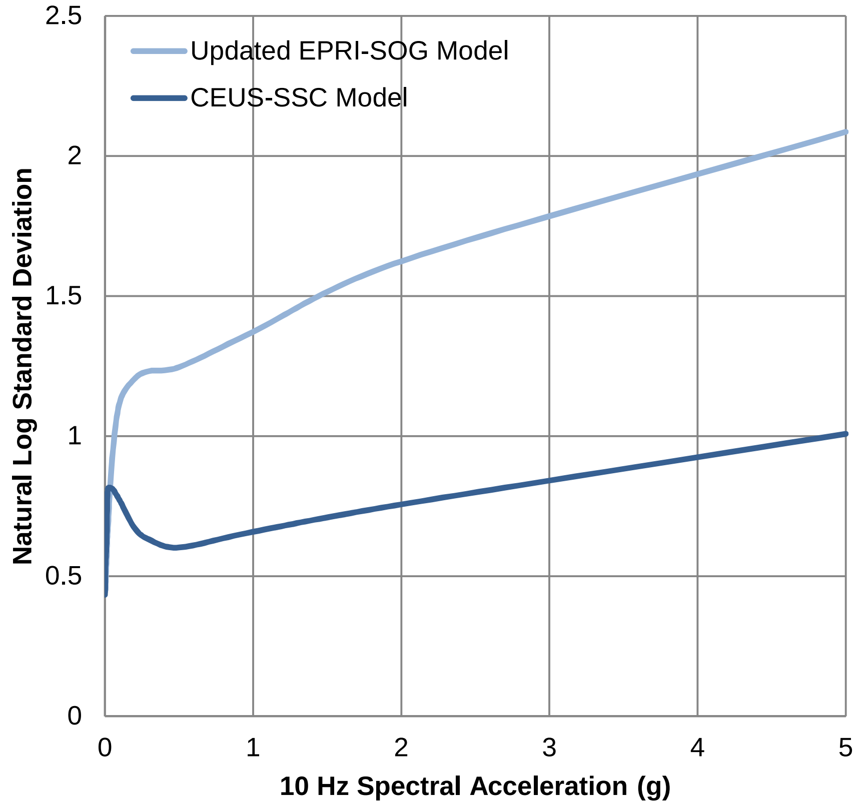
Hazard Curve Uncertainty (Continued)

Comparison of Applicant's EPRI-SOG and CEUS-SSC Results





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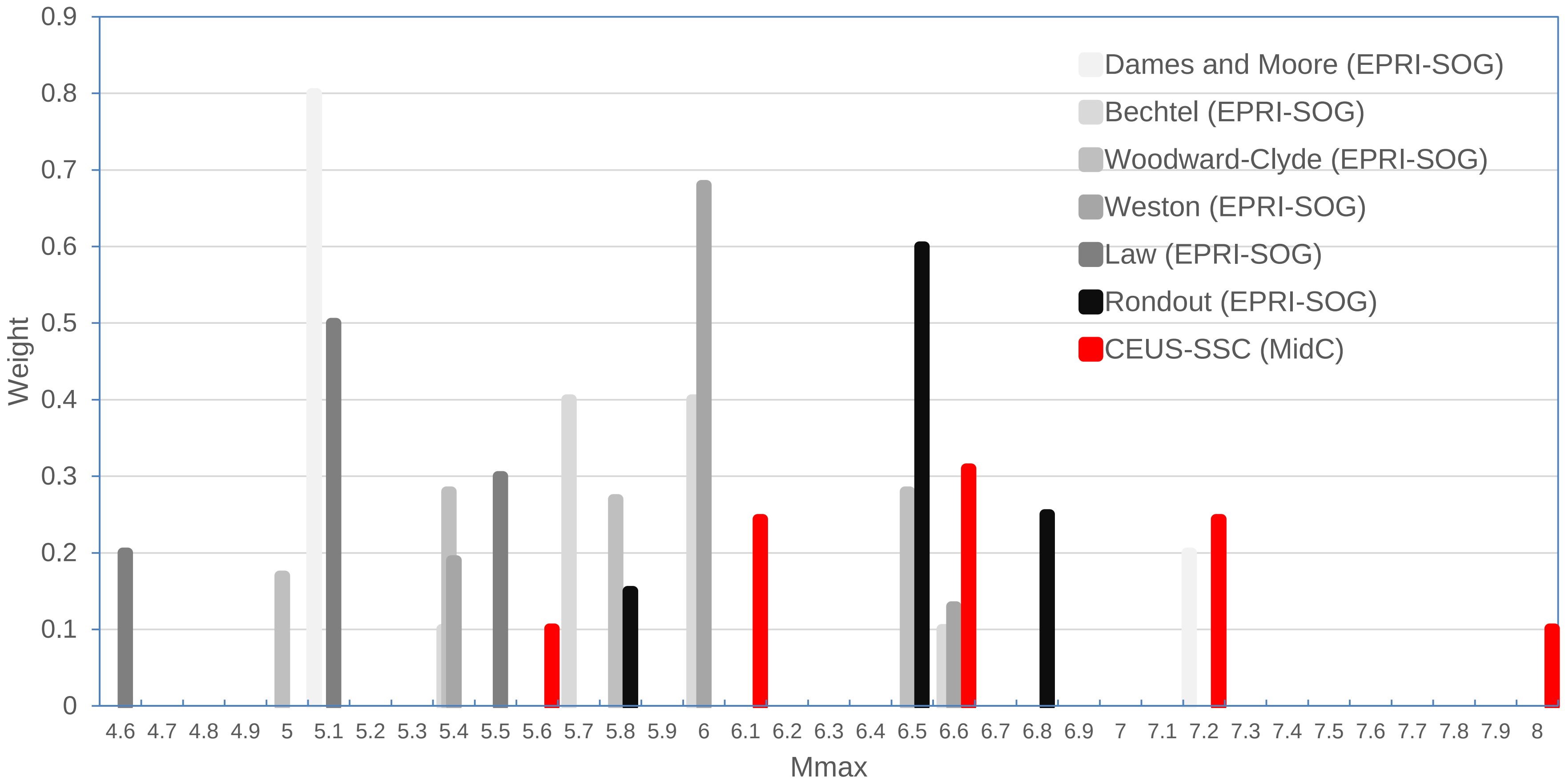
Hazard Curve Uncertainty

Comparison of EPRI-SOG and CEUS-SSC Mmax Distributions for Host Source Zones



Presentation to the ACRS Full Committee

Fermi Unit 3
COL Application Review

NTTF Fukushima Recommendations

September 4, 2014

Site Characteristics

Presentation Outline

- **Overview of Fukushima Recommendations 4.2, 7.1 and 9.3**

- **Technical Staff**
  - BPFP, Chief, Antonio Dias
  - BPFP, Technical Review, Angelo Stubbs
  - BPFP, Technical Reviewer, Raul Hernandez
  - NSIR/IRIB, Technical Reviewer, Eric Schrader
  - NSIR/NRLT, Technical Leader, Dan Barss

Fukushima Recommendation 4.2

Presented by:
Angelo Stubbs

Fukushima Recommendation 4.2

<u>US NRC Order EA-12-049</u> requires nuclear facilities to implement mitigating strategies for beyond-design-basis external events (BDBEE) using a three-phase approach.

- The first (Initial) phase relies on the use of installed equipment and resources to maintain or restore core cooling, SFP cooling, and containment function
- The second (transition) phase allows for the use of portable, onsite equipment and consumables to maintain or restore core cooling, SFP cooling, and containment function until resources brought off site are available
- The third (final) phase requires obtaining sufficient offsite resources to sustain function indefinitely

Fukushima Recommendation 4.2 (cont.)

Staff Evaluation

The Fermi 3 Mitigating Strategies for BDBEEs was evaluated by the staff with respect to NRC Order EA 12-049. Information reviewed included, DTE's responses to staff's RAI's, information in FSAR Section 1.5.1.1.1, and DCD information incorporated into the Fermi 3 FSAR by reference. The staff found that the Fermi 3 Mitigation Strategy will adequately addresses recommendation 4.2 for the following reasons:

- Fermi 3 uses ESBWR standard design that includes passive design features that provide core, containment, and SFP cooling capability for 72 hours without reliance on AC power or operator action, and thus has an inherent 72 hour coping capability as part of its design basis.

- Fermi 3 SBO coping for the first 72 hours is accomplished using only installed safety-related plant equipment (i.e. isolation condenser system, and passive containment cooling system pools (PCCS) or Gravity-Driven Cooling System (GDCS).

- After 72 hours, final phase mitigation will address the indefinite extension of the coping and address offsite assistance requirements as well as procedures, guidance , training, acquisition, staging, equipment installation, etc. The staff imposed License Condition 20.2-1 to insure that the required strategies and guidance will be implemented to provide for post 72 hour coping.

Fukushima Recommendation 4.2 (cont.)

License Condition (20.2-1) Mitigation Strategies for Beyond Design-Basis External Events

At least one (1) year before the latest date set forth in the schedule for completing the inspections, tests, and analyses in the ITAAC submitted in accordance with 10 CFR 52.99(a), DTE Electric Company shall use the guidance contained in JLD-ISG-2012-01, "Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," Revision 0 and the information presented in Fermi FSAR Section 01.05 to complete the development of strategies and guidance for maintaining and, if necessary, restoring core cooling, containment, and spent fuel pool cooling capabilities beginning 72 hours after loss of all normal and emergency ac power sources, including any alternate ac source under 10 CFR 50.63. These strategies must be capable of:

- Mitigating a simultaneous loss of all ac power sources, both from the onsite and offsite power systems, and loss of normal access to the normal heat sink,
- Maintaining core cooling, containment, and spent fuel pool cooling capabilities for Fermi Unit 3 during and after such an event affecting both Fermi Units 2 and 3, and
- Being implemented in all plant modes.

Before initial fuel load, DTE Electric Company shall fully implement the strategies and guidance required in this license condition, including procedures, training, and acquisition, staging or installing of equipment and consumables relied upon in the strategies.

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Fukushima Recommendation 4.2

Questions

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Fukushima Recommendation 7.1

Presented by:
Raul Hernandez

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Fukushima Recommendation 7.1

- **US NRC Order EA-12-051**, "Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation," requires reliable spent fuel pool instrumentation.

- **JLD-ISG-2012-03** ,"Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation," defines the design features and programmatic requirements credited in defining level instruments as reliable.

Fukushima Recommendation 7.1 (continued)

- The staff found that the Fermi 3 SFP level instrument meets all the design and programmatic requirements described in JLD-ISG-2012-03 and, therefore, is in compliance with Commission Order EA-12-051
  - ESBWR design of the safety-related level instrument already addressed most of these features
  - Fermi 3 FSAR Section 1.5.1.1.2 expanded the level instrument design description to address the equipment power supply and accuracy
  - Level instruments will be permanently installed and, therefore, the development of procedures, testing and calibration requirements is within the scope of FSAR Tier 2 Section 13.5
  - License condition 20.3-1 addresses the development and implementation of a training program to ensure that personnel will be trained in the provision to establish alternate power connections to the level instruments

Fukushima Recommendation 7.1 (continued)

- **ACRS Action Item**: Environmental Qualifications for SFP Instrumentation
  - Order EA-12-051: “The primary and backup instrument channels shall be reliable at temperature, humidity, and radiation levels consistent with the spent fuel pool water at saturation conditions for an extended period. This reliability shall be established through the use of an augmented quality assurance process (e.g. a process similar to that applied to the site fire protection program).”
  - Fermi 3 incorporates by reference the ESBWR design which includes a passive spent fuel pool and buffer pool cooling designed to allow pool heat-up and boiling for up to 72 hours. The spent fuel pool and buffer pool are designed with alarm setpoints as low as the top of the active fuel. This is the same safety-related monitoring instrumentation used for addressing NTTF 7.1.

Fukushima Recommendation 7.1

Questions

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Fukushima Recommendation 9.3

Presented by:
Eric Schrader

Fukushima Tier 1 - NTTF Recommendation 9.3
Staffing and Communications

Recommends that the NRC require that facility emergency plans address prolonged SBO and multiunit events by:

- Determining and implementing required staffing to respond to a multi-unit event
  - RAI 01.05-2 asked the applicant to assess the staffing needs and communications systems and equipment used during an emergency event.
- Accessing communications equipment needed onsite and offsite during a prolonged SBO.
  - SECY-12-0025 – required communication equipment relied on for an extended loss of ac power have adequate power to coordinate the response
- The applicant purposed a License Condition to addresses the Fukushima 9.3 recommendations:
  - The applicant will complete an assessment, at least 2-years prior to initial fuel load, of on-site and off-site communications systems and equipment required to ensure communications capabilities can be maintained during prolonged station blackout condition.
  - The applicant will complete an assessment, at least 2-years prior to initial fuel load, of the on-site and augmented staffing capability to satisfy the response to a multi-unit event
  - Affect all corrective actions identified by both assessments at least 180 days prior to initial fuel load

Fukushima Recommendation 9.3

The staff reviewed applicant's License Condition (LC) and modified it to remove reference to initial fuel load and instead reference schedules required by 10 CFR § 52.99(a) and 10 CFR 52.103(a) which establishes the date of initial fuel load. The staff finds the revised LC an acceptable approach because it confirms to the guidance provided in:

- SECY-12-0025 states, in part, that the staff will also request all COL applicants to provide information required by the orders and request for information letters described in this paper, as applicable, through the review process.

- NEI 12-01, "Guideline for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities", Revision 0.

Fukushima Recommendation 9.3

Questions

Presentation to the ACRS Full Committee

Fermi Unit 3
COL Application Review

ACRS Action Items

September 4, 2014

Presenters:

Yui Law, Technical Reviewer, MEB

and

Ryan Nolan, Technical Reviewer, BPFP

Closure of Open Item 03.02.01-3 related to list of SSCs for continued safe operation following an OBE

- ACRS requested that the NRC staff explain the close-out of Open Item 03.02.01-3 in Fermi 3 SER. The SER was not clear how the RAI response, which discussed RTNSS equipment, resolved the request for the SSC list for an OBE.
  - SER has been revised to clarify the open item, which was discussed in North Anna RAI 03.02.01-7.

- SRP Section 3.2.1 provides guidance to request a list of SSCs necessary for continued safe operation during and following an OBE. 10 CFR Part 50, Appendix S, Section IV(a)(2)(i)(A) states that if the OBE ground motion is set to one-third or less of the SSE, then the requirements associated with OBE ground motion in 10 CFR Part 50, Appendix S, Section IV(a)(2)(i)(B)(I) can be satisfied without the COL applicant performing explicit response or design analysis.
  - Appendix S is intended for the design of the safety-related SSCs to perform the safety functions.
  - OBE serves as a threshold for whether to shut down a plant. RGs 1.166/1.167 provide guidance on pre-earthquake planning and post-earthquake actions.
  - Safety-related SSCs are designed to SSE, which bounds OBE if OBE is set to be 1/3 or less of SSE.

Wind and Missile Loading on Structures Housing RTNSS 'B' SSCs

- Seismic Category I Structures
  - Tornado wind (330 mph)
  - Tornado missiles
- Seismic Category II Structures
  - Tornado wind (330 mph)
  - Hurricane missiles (195 mph)

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Questions

Backup Slide

ESBWR DCD and RTNSS ‘B’ Policy

	RTNSS B SSCs Hurricane Design	RTNSS B SSCs Tornado Design
“Callan Memo” 1997	Category 5 wind load and missiles (200 mph)	n/a (specifically excluded in memo)
ESBWR DCD	Missiles (195 mph)	Wind load (330 mph)