Official Transcript of Proceedings

NUCLEAR REGULATORY COMMISSION

Title: Advisory Committee on Reactor Safeguards

Docket Number: (n/a)

Location: Rockville, Maryland

Date: Thursday, May 5, 2016

Work Order No.: NRC-2371 Pages 1-165

NEAL R. GROSS AND CO., INC.
Court Reporters and Transcribers
1323 Rhode Island Avenue, N.W.
Washington, D.C. 20005
(202) 234-4433

DISCLAIMER

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

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

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

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

+ + + + +

634TH MEETING

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

+ + + + +

THURSDAY

MAY 5, 2016

+ + + + +

ROCKVILLE, MARYLAND

+ + + + +

The Advisory Committee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B1, 11545 Rockville Pike, at 8:31 a.m., Dennis C. Bley, Chairman, presiding.

COMMITTEE MEMBERS:

DENNIS C. BLEY, Chairman

MICHAEL L. CORRADINI, Vice Chairman

PETER RICCARDELLA, Member-at-Large

RONALD G. BALLINGER, Member

CHARLES H. BROWN, JR. Member

DANA A. POWERS, Member

HAROLD B. RAY, Member

JOY REMPE, Member

GORDON R. SKILLMAN, Member

JOHN W. STETKAR, Member

ALSO PRESENT:

STEWART BAILEY, NRR

JOSEPH BELLINI, Exelon/Aterra Solutions*

ERIC BOWMAN, NRR

MARK CARUSO, NRO

BILL GALYEAN, NuScale*

MARVIN LEWIS, Public Participant*

LYNN MROWCA, NRO

WILLIAM RECKLEY, NRR

JOSEPH SEBROSKY, NRR

MOHAMED SHAMS, NRR

OMID TABATABAI, NRO

MARK TONACCI, NRO

MICHAEL TSCHILTZ, NEI

ANDREA VALENTIN, Executive Director, ACRS

TOM ZACHARIAH, NEI

*Present via telephone

TABLE OF CONTENTS

P R O C E E D I N G S

8:31 a.m.

CHAIRMAN BLEY: The meeting will now come to order. This is the first day of the 634th meeting of the Advisory Committee on Reactor Safeguards.

During today's meeting, the committee will consider the following: additional guidance to support the closure plan for the reevaluation of flooding hazards; review of Fukushima Tier 2 Group 3 recommendation regarding other natural hazards screening evaluations; the NuScale Topical Report TR-0515-13952, Risk Significance Determination, Use of RAW Importance Measures, R-A-W; preparation of ACRS reports.

This meeting is being conducted in accordance with the provisions of the Federal Advisory Committee Act. Mr. Mike Snodderly is the Designated Federal Official for the initial portion of this meeting.

We have received no written comments or requests to make oral statements from members of public regarding today's sessions.

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

presentations and committee discussion.

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

I also want to make you aware that this meeting is being webcast with the ability to view our presentation slides on the web. Those out on the bridge line might want to do that primarily because the audio is better and you can follow the presentations through the vugraphs. You can dial into the bridge line or you can connect through the NRC's public meeting website and click on the link. It usually works and the sound is reported to be very good. In fact, I've listened to it. It is. If it doesn't work, please call our office.

The committee would like to introduce and welcome Yvonne Wall. Yvonne comes to us from the Office on Nuclear Security and Incident Response on a three-month rotational assignment as the Executive Director's Administrative Assistant. Welcome, Yvonne.

At this point, I'll turn the meeting over to Member Stetkar, to lead us through the first topic.

MEMBER STETKAR: Thank you, Mr. Chairman.

I'll make this introduction brief. This session is inter-staff guidance on activities related to focused evaluations and integrated assessment of external flooding hazard. Our Fukushima Subcommittee reviewed the matter really recently. It seems so long ago, but a couple of weeks ago on April 22nd, so this should be fresh in the minds of most of our members.

I think the staff will lead us in their introduction through the torturous path of how we got to where we are with this topic. And with that, I'll turn over the proceedings to Mohamed Shams.

MR. SHAMS: Thank you. Thank you, Mr. Chairman and distinguished members. I just want to take a minute and lay out what we're trying to do here in our presentation.

As Dr. Stetkar indicated, we were here a couple of weeks ago and we had the opportunity to interact with the subcommittee and go in detail over the guidance itself. So I don't want to belabor that, so it is again a guidance about evaluating plant responses to flooding. We've taken on an activity related to the Japan Lessons Learned activities related to the Fukushima accidents to reevaluate the hazards for all sites, for all operating reactor sites. So this activity is to describe the guidance

related to sites that have exceedance in a hazard and how they are going to deal with it.

Part of the feedback we received last when we talked with the subcommittee, was to explain the landscape on how this activity fits in the broader scope of our reevaluated hazard. To just put a pointer on that, late last year or middle of last year, the Commission directed us to carry on with two activities. One relates to ensuring that mitigating strategies are protected and deployable for the reevaluated hazard and one relates to continuing with the 50.54(f) letter assessment such that we have the ability to identify any additional safety margin enhancements that one can identify.

This guidance relates to the 50.54(f) letter assessment again searching for additional safety enhancements. We've been interacting with you on the mitigating strategies, reevaluation under the mitigating beyond design basis rule. That's where the guidance is. That's where the activities reside. And we met with you on that, again, on the 22nd. And we plan to meet again later on this year to talk with you again and get your insights on the guidance.

So we'll go through that. We'll go through the guidance itself and what the guidance

entails and our clarifications, if any. And we'll also lay out for you the landscape and hopefully we may be clear this time around what we're doing and where this activity fits.

With that, I'll turn it over to Eric and look forward to your comments and questions on this activity.

MR. BOWMAN: Thank you, Mohamed. Good morning, Chairman, members of the committee. I'm Eric Bowman. I'm a Special Advisor in the Japan Lessons Learned Division. I had the privilege of briefing the subcommittee on the 22nd of April on the interim staff guidance document that's the subject of this presentation. That number is JLD-ISG-2016-01 and it provides guidance for the focused evaluations and the revised version of the integrated assessment process for licensees responding to the 50.54(f) on external flooding reevaluation.

The purpose of the guidance is to provide guidance for the closure of the hazard reevaluation process by endorsing an industry developed guidance document, NEI 16-05, with some clarifications in order to give us a graded approach to identify the need for and to prioritize the scope of the integrated assessments. The revised integrated assessment

process under this interim staff guidance document using NEI 16-05 will provide an input to an additional guidance document we are in the process of developing that will lay out the criteria for regulatory decision making.

As Mo mentioned, we committed to providing the committee with a presentation, a map if you will, of how everything fits together with respect to the mitigating strategies and the hazard reevaluation. This is a large, if you will, 50,000-foot view of the lay of the land for it. We've got two separate processes going on with respect to addressing the reevaluated hazards.

On the left is a depiction of what we're terming the mitigation strategies assessments and those are intended to evaluate the mitigating strategies that were developed by the licensees under the mitigating strategies order to show that either they are capable of mitigating -- addressing the reevaluated flood hazard levels, or they can be modified in order to address those reevaluated flood hazards.

On the right hand side of the slide is what's going on with the 50.54(f) process for the reevaluated hazards. In this ISG, we're going through

a focused evaluation to give us the graded approach in order to screen out licensees that we do not believe will have a potential for safety improvements that would justify further regulatory action.

If a licensee does not screen out, they would go down the process of conducting the revised integrated assessments and then we'd go into the follow-on guidance that we'll be developing for the regulatory decision making.

VICE CHAIRMAN CORRADINI: So all licensees have to go through the blue and the green?

MR. BOWMAN: Yes.

VICE CHAIRMAN CORRADINI: So -- I was afraid you were going to make it more complicated.

MEMBER STETKAR: It gets a lot simpler.

MR. SHAMS: Let me go back to just a slight correction, the previous slide, can I go back to the previous slide?

So all licensees go through the blue. The green, not quite. Some licensees that their hazard, their evals did not exceed their current license and current design basis would not need to go through the green. They're already closed out.

MEMBER STETKAR: Is that what screen out means?

MR. SHAMS: We can think it as such, but I --

MEMBER RICCARDELLA: Actually, it would be the screen out before even getting to this guidance because their reevaluated flood hazards did not exceed the design basis flood hazard level.

MEMBER STETKAR: When you say -- but for clarity, when you say "this guidance" you mean JLD-ISG-2016-01.

MR. BOWMAN: The guidance that is under consideration by the committee in this meeting. But when I speak of licensees, I'm only speaking of operating reactor licensees, operating power reactor licensees. We are not talking about combined license holders that just got their licenses through the Office of New Reactors. They were not subject to the 50.54(f) letter.

VICE CHAIRMAN CORRADINI: Okay, but can I say it back to you since I played hooky that Friday. I wasn't here. So what we're speaking about today is guidance for the green path?

MR. BOWMAN: Yes, correct.

VICE CHAIRMAN CORRADINI: And we've yet to see -- or we're still in discussion, as I understand it, with the guidance for the blue path. Because

we're going to revisit that and all its complicity in July.

MR. SHAMS: Yes and no. We've been interacting with you on this. You've seen Appendix G related to flooding and now we've talked to the subcommittee about also the updates on the seismic size as well --

MEMBER STETKAR: Mohamed, to get people indexed quickly, think blue path is Appendix G and H to NEI-1206. Okay, if that will settle in. And the draft regulatory guide that will be a compendium of that will eventually go on with the rulemaking, you have the mitigation of beyond design basis external events rulemaking. That's the blue path stuff.

The green path stuff is what we're talking about today, but as they'll say there's sort of a -- they're not completely independent.

MR. SHAMS: When I say yes and no, we provided some. We owe you some more and we'll come back and talk with you later on.

MEMBER STETKAR: But what we're talking about in July is the continuation of the green path stuff.

MR. SHAMS: Correct.

MEMBER STETKAR: But July right at the

moment.

MR. SHAMS: Right. We'll talk a little later on that.

MEMBER STETKAR: We'll talk about that later.

MR. SHAMS: Yes.

MEMBER RAY: John or -- the thing that interests me is how the green path is being affected as we're in it now by what we anticipate occurring in the blue path. And I don't know whether that's what this slide -- I was waiting to see if that's what this slide is going to tell me, but that's what I'm most interested in. How is it, as we look at the green path, we're paying attention to oh well, but we're going to solve this over in the blue path.

MR. BOWMAN: Okay, to try and give you a preview, they are fundamentally following different regulatory processes, but we are recognizing that there is a lot of work that's being done on the individual paths that can be relied upon in the other path in order to achieve efficiency in the use of resources and make it a more effective overall effort.

MEMBER RAY: I realize this is very hard to articulate as to exactly how this takes place, but it seems clear that the green path is being influenced

by the blue path. The question is how. It's not just flooding.

So as I say, one more time, that's what is of most interest to me. I'm not quite able to digest what John said about the appendices, but the interaction and to what extent going down the green path we're keeping in mind, oh well, but we're going to go down the blue path, too, and that's going to enable us to do something different than the green path than we would if there were no blue path. That's what I'm most interested in.

MR. BOWMAN: And I think we've articulated very well -- we're actually very cognizant of the fact that the two paths are parallel, they interact with each other. You'll see in the guidance that we have specific revisions on if assessments were done in the blue path, you need to take or can have the opportunity to take advantage of that in the green path.

Also, at the end of the green path when one assesses what additional safety enhancements need to be added, one would have to recognize that there are safety enhancements gained already in the blue path and to what degree we want to add beyond what we've already achieved in the blue path.

MEMBER RAY: Well, basically, the blue path stems from the idea that we may exceed the design basis. We need to be able to mitigate that. But then it raises the question inevitably to what extent do we not make changes that would otherwise be made in the design basis because we have the mitigating capability. And that's -- I know at the Commission level that's a huge issue for the Agency as a whole, and I just think we ought to try and focus on that enough so that we understand it and it isn't just somewhere in the background, but we don't know how it works.

MR. SHAMS: Yes, it is not and that's actually -- it is not forgotten, I should say. And it is the focus of the Phase 2 guidance which is the reason it's difficult because we're trying to draw that line in the sand to what degree we should take credit for the mitigating strategy, not over sell it and also not under sell it.

MEMBER RICCARDELLA: Could I just try to understand? As I understand it, the blue path refers to ability to deal with two certain things, loss of offsite power and loss of access to the ultimate heat sink.

MR. BOWMAN: That is true to a certain

extent. It's more complicated than that and I'll get to that.

MEMBER RICCARDELLA: But I would think the green path may have to consider some different scenarios, right?

MR. BOWMAN: Oh, yes.

MEMBER RICCARDELLA: Maybe not so much for flooding, but certainly for seismic you would have to consider things that happened that aren't necessarily related to those two specific things.

MR. SHAMS: In a lot of ways, the green path is a bit more actually free, in the sense that it's free in the sense that the event that happens and whatever consequential failures that come from that event are considered and those that did not happen would not be considered.

MEMBER RICCARDELLA: Right.

MR. SHAMS: On the other hand, the blue path is a very determined, stylized event that we start with.

MR. BOWMAN: If you will, I can run through this diagram quickly and try to lay out how things interact and then after that, we can answer any questions or clear up anything that I've made even less clear by talking about this slide.

This is a more detailed depiction than the prior slide that includes the regulatory instruments that were issued. Where we see the boundary between the order that was issued after the Fukushima event on the mitigating strategies and the upcoming mitigation at the end, design basis events rulemaking, and what the guidance that's directing what's happening, as well as on the right side what's going on with the 50.54(f) letter and the direction we've received from the Commission on the subject.

Starting on the top left part, after Fukushima Daiichi, we issued the mitigating strategies order. That's Order EA-12-049 and the licensees, the operating power reactor licensees, have been developing and implementing the mitigating strategies taking into account for the most part the external hazards at the current design basis levels. Those levels were informed by other processes going on to the extent that they could. Licensees took into account what they believed would be the outcome of the hazard evaluations that were underway in response to the regulatory instrument on the right-hand side of this vugraph which is the request for information that was issued on the same day as the orders under 50.54(f) to reevaluate seismic and flooding hazards.

In the guidance document for the mitigating strategies and that's in this box here, our interim staff guidance document, JLD-ISG-2012-01 at its endorsement of NEI 12-06, Revision 0, for the flooding hazards, we had licensees look to flooding evaluations that had been accomplished for adjacent sites, nearby early site permits, and other information they might have rather than merely looking to the information that was in the final safety evaluation or safety analysis reports, so that they had a better understanding of what they would likely need to be able to address in the end.

Going down the request for information path on the reevaluated hazards, we had a couple of interactions with the Commission on the situation, in order to try and harmonize the efforts that were going on, on both the part of the licensees and on the part of the staff, for the development of mitigating strategies and the reevaluation of the flooding hazard in particular. The first of those interactions was a document that went up to the Commission, COMSECY-14-0037. You had a number of interactions with us on that and provided a recommendation to the Commission on the subject.

In that interaction, we had suggested the

integration of the two bodies of work viewing that the establishment of mitigating strategies that were capable of addressing the reevaluated hazard would provide sufficient safety benefits to essentially make the regulatory decision making for the 50.54(f) letter no longer an evaluated activity.

The Commission directed that we instead continue down the path of having the mitigating strategies order, the strategies that were developed under that order, address the reevaluated flooding hazards and still look to the results of the 50.54(f) reevaluation of the flooding hazard to see if there would be any more safety gains that would be worth achieving through regulatory action. And that's what we are working on in this interim staff guidance document, JLD-ISG-2016-01, that's the subject of today's meeting and the follow-on document that's under development for the regulatory decision making.

VICE CHAIRMAN CORRADINI: So I think I get it, but can I say it back to you in simpler terms, or at least in my terms?

MR. BOWMAN: You can try.

VICE CHAIRMAN CORRADINI: Okay, so the current policy as determined by the Commission is that if I do the reevaluation, let's forget about colors,

because I've got to do the reevaluation regardless, and I do the reevaluation in the presence of mitigating strategies, I don't have to redesign -- I don't have to change my design base. I can simply mitigate against the design base if I exceed it.

MR. BOWMAN: That is a potential outcome. However, the regulatory decision making under the 50.54(f) letter will need to look into the licensee has established a capability to mitigate without changing the design basis of the revised reevaluated flooding hazard level. There may be a safety benefit from in addition to the mitigating strategies capable of addressing the flooding level doing something else. Because it may be more effective to, for example, protect a set of emergency diesel generators and prevent the loss of all AC power, rather than going down the path of mitigating the loss of all AC power.

MEMBER RAY: That's key, what you just said, that example. It's just an example, but it's very important because there's maybe a tendency to cut it off and say we don't need to worry about it because we can mitigate it if it happens, but the benefit opportunity would be missed in that case.

MR. BOWMAN: Exactly. And there is an interaction between what is the actual risk that's

posed by the reevaluated flood hazard level. Do we have the current state of the art in the flooding evaluations to say that it is a 10^{-6} flood or a 10^{-5} or 10^{-4}. And we'll talk about that that a little bit later on in the presentation.

VICE CHAIRMAN CORRADINI: So one last thing, it's kind of not on your plate, but I'm sure you're thinking about it. If I were to look at the 99 current operating plants and I do a little event tree that you've got to do this first and this second and this third and then I get a binary step that nah, no, I screened out, so I'm okay, but no I didn't screen out, so I've got to do this.

Have you thought through how all this plays out relative to all the various things? I assume the industry has and they're going to explain to us how they thought about it. But to me, I'm curious if staff has figured out how all this plays out through numbers going through these various pathways or has there not been enough evaluation even to determine? Do you see what I'm asking?

MR. SHAMS: If I understand that question correctly --

VICE CHAIRMAN CORRADINI: In other words, are 70 -- to pick numbers -- are 70 of them screened

out through the simpler boxes and I'm only dealing with 29 or am I dealing with 70 that I had to go through these?

MR. BOWMAN: In the flooding area, we believe that for the revised integrated assessments, we will wind up with on the order of 10 to 15 plants that need to go down that path.

VICE CHAIRMAN CORRADINI: Okay, thank you.

MR. BOWMAN: And in the seismic area, it's about 20 that will be doing the seismic probabilistic risk assessment. That's outside the scope of this presentation. We're just focusing on flooding here.

VICE CHAIRMAN CORRADINI: Thank you.

MEMBER STETKAR: We have to be a little cognizant of time and we have time for the industry.

MR. BOWMAN: To finish up the slide on the lower left hand part are the activities going on with the rulemaking that's underway that we also briefed the subcommittee on the 22nd. We have revised industry guidance document, NEI 12-06 Revision 2, that includes Appendices G and H to talk about how they will look at the mitigating strategies for flooding and seismic hazards respectively.

We anticipate we'll get another version of NEI 12-06 to add the one piece that was missing which

was the process for addressing plants that are doing the seismic probabilistic risk assessment.

The outcomes of the mitigating strategies assessments using those guidance documents will be either mitigating strategies, that is, strategies to mitigate the effects of the initiating event, assuming that it results in a loss of all AC power and a loss of normal access to the ultimate heat sink, either as they were initially devised or modified in order to address the reevaluated hazards.

The other alternative is what we've labeled as alternate strategies. They would be as they're laid out in Appendix G as alternate mitigating strategies or targeted hazard mitigating strategies for flooding that do not make the assumption that you've had an extended loss of AC power and a loss of normal access to the ultimate heat sink, but instead treat the event mechanistically rather than deterministically.

Are there any more questions on the lay of the land with how these two interrelate?

MEMBER REMPE: Just a comment. I appreciate you making this diagram and going through it. It makes it easier to follow, in my opinion. Thank you.

MR. BOWMAN: Thank you. In the end, what we see is the regulatory outcomes we'll have. Under the 50.54(f) letter, licensees already took interim actions to address the reevaluated hazards and we anticipate that there will be commitments such as may be necessary to justify improving the realism of the hazard reevaluation to give us something that's closer to what we would anticipate a true hazard to be. Those commitments could be to make plant modifications or to put in place programs and procedures such as procedures to check the clearance of drain systems prior to an anticipated flooding event.

And then the other outcome, of course, would be going down the path of regulatory decision making. If we need to impose further requirements using orders or requests for additional information or issue demands for information, then that would be another potential outcome.

Under the rulemaking, the mitigation of design basis events rulemaking, the two types of mitigating strategies that I talked about, the pure flex mitigating strategies, if you will, to use the industry terminology for it that assume that there is a loss of all AC power, concurrent with a loss of normal access to the ultimate heat sink at the

reevaluated flood hazard or the ultimate mitigating strategies or targeted hazard mitigating strategies. And those would not be adjusting to get a lower level than a bounding level for the flooding hazards.

The industry's proposed guidance that we're looking at in this interim staff guidance document is NEI 16-05. We published the guidance document itself by reference in the Federal Register on the 22nd of April. The comment period for that runs through the 23rd of May. I've got the page number for the Federal Register notice and the docket ID number on the presentation for the reference on anyone that's participating in this meeting, so you can look it up and make appropriate comments.

I included the diagram from NEI 16-05 to show you the different paths that the flooding focused evaluations and revised integrated assessments will go down following their guidance document. The different paths, the ones in the top three on this flow chart are what we term the focused evaluations. The two that end in the red blocks or the bottom two are the revised integrated assessment paths. The reason they're separated in this manner, the ones that terminate in the orange blocks, the focused evaluations, are the ones where the outcome is a

demonstration of an ability to protect against the revised flooding hazard. And also the path 3 which is an evaluation of the local intense precipitation path.

For the local intense precipitation path, we follow the addressing of that hazard in the mitigating strategies order. And we've looked at that and concluded that there will be no need to take further regulatory action on it. We'll talk about that a little bit later.

MEMBER RICCARDELLA: You specifically used the word protect when referring to those green -- to those orange ones.

MR. BOWMAN: Yes.

MEMBER RICCARDELLA: And could you draw that line that the top three are protection versus the bottom two are mitigation?

MR. BOWMAN: Well, the top two are protection for the reevaluated hazards. The third one, it can incorporate mitigation of the local intense precipitation hazard. But that's the reasoning underlying how the industry put together this flow chart.

In the Commission's direction to the staff in SRM-COMSECY-15-0019, as well as in the prior SRM that we received, that's staff requirements

memorandum, on COMSECY-14-0037, we were told to look to areas where we could make the evaluation of the flooding hazard more realistic by removing over conservatisms and in the prior one, the 14-0037 staff requirements memorandum, it included looking for areas where conservatism was not adequate to represent what the realistic hazard was.

In NEI-1605 and in the ISG that we're talking about here, we are looking to the hierarchical hazard assessment process from NUREG/CR-7046 as the process that will be used to look for areas where we can reduce the conservatisms and achieve a more realistic evaluation what the real hazard is.

NEI-1605 Appendix A includes a catalog of potential areas that licensees can look to and try to determine if there are indeed over or under conservatisms. It's a very site-specific application of the items that are in Appendix A. The staff plans to look at those on a case-by-case basis because there are areas in that catalog of potential sources of conservatism that may be over or under conservatism.

Okay, NEI-1605 gives a couple of different sections that deal with an initial evaluation of the impact of the flooding hazard and the determination of the numerical value of the available physical margin.

We've looked to those sections and agree that they provide an acceptable method of doing that. We did have to make a couple of clarifications for the determination of available physical margin. The clarifications are listed on this slide and they have to do with consideration of flood penetration seals and what the capability of those flood penetration seals are with respect to the reevaluated flood hazard levels.

NEI-1605 incorporates by reference a request for additional information that was issued for the flooding walkdowns in 2013. That RAI was specific to the capability of the flood penetration seals at the current licensing basis. We're clarifying that it is appropriate to use the considerations of that RAI, but it should be done at the reevaluated flood hazard level rather than the current licensing basis. And we're also clarifying that operating experience on the use of temporary barriers for flooding should be considered in looking to the available physical margin.

Path 1 which is the first of the five paths, if a licensee is able to go through and using the hierarchical hazard assessment process reduce the outcome of the flooding evaluation such that it's

bounded by the current design basis, that's an appropriate way to disposition the flooding hazard reevaluation for those particular flooding mechanisms because the current licensing basis would be capable of addressing the flooding hazard.

Path 2 is similar, but it looks to the effective flood protection that would be available because there is available physical margin. This would be the path that would be taken for flood mechanisms that a licensee can provide protection against, rather than mitigation of. And we make a similar clarification on the RAI that was issued for the flooding walkdowns for the flood penetration seals.

The results of the evaluation of the flood protection include the capability to use temporary flood protection measures. We'll be looking to the use of the flood protection measures, temporary and permanent, using qualitative evaluations relying on engineering judgment and operational judgment because of the lack of a good methodology for determining the frequencies of exceendance as we had laid out to the Commission in the flooding action plan in COMSECY 15-0019 and as the Commission approved in its SRM on the subject.

Okay, one area of particular concern that we spoke to the subcommittee about was the use of the evaluation of overall site response. The overall site response in NEI 16-05, the evaluation there relies on the feasibility determinations that are being accomplished for the mitigating strategies under NEI 12-06, Appendix E which provides the guidance for the conduct of validation.

The genesis of that particular appendix, it came about because the mitigating strategies order itself did not require an evaluation of human performance. However, the industry guidance specifies that licensees will provide a reasonable basis to show that they can meet the time criteria that they need to accomplish in order to perform the mitigating strategies.

VICE CHAIRMAN CORRADINI: Can I say that back to you? I'm just trying to understand. So I've gone through the boxes. I understand the first box. I understand the second box. So this is the orange box, but it requires some sort of mitigation that is dependent upon timing. Do I have that approximately right?

MR. BOWMAN: You have it approximately right, but it also impacts the second box because of

the presence of a potential for reliance on temporary flood measures that would require some timing to put those flood measures in place either by shutting a door or building a sandbag barrier or something like that or even to the extent of closing valves or starting a pump.

In the mitigating strategies area, the mitigating strategies order does not have any boundaries to the conditions under which the actions that are required by that order would have to take place. That is largely an outcome of several actions that were taking place in concurrence with the issuance of the orders that went out on March 12, 2012.

We were in parallel considering NTTF Recommendation 1 which included a recommendation that the Commission establish a beyond design basis extension category of events. If we had gone down that path, and said a beyond design basis extension category of events, we could have established, for example, that the mitigating strategies under the mitigating strategy order be capable of addressing a flood that was 30 feet higher than the design basis flood level of the facility or a seismic event that 1.67 times the size of the seismic event that the

facility was licensed to or any individual set of hazards that set the performance criteria and the reference bounds for which that facility was licensed.

Because we were not authorized to set that type of beyond design basis extension criteria, our conclusion was that we would not be able to establish with any degree of certainty what the effects on the performance shaping factors that would be necessary for a consideration of reliability would be.

MEMBER STETKAR: Eric, you're kind of going into a lot of -- a simple answer is you have to show that the actions are feasible regardless of whether you're putting in barriers or whether you're mitigating it. And the feasibility is Appendix E of NEI 12-06.

MR. SHAMS: And that applies to box 2, 3, 4, and 5.

MEMBER RAY: But many of us here went through recently an operating license issuance for a wet site that you could say uses mitigating strategies for certain flooding conditions. Which box would it fit in? Could you say it's most like box path 1 or 2 or 3?

I'm talking about the recent plant start up licensing action that we were -- because you

certainly mitigate in that case, taking steps very much like -- not mitigate, that is not the right word.

You certainly take steps to -- that are part of a licensing basis to address wet site conditions. And I was wondering if that was most like one of these boxes that you've just been describing.

MR. BOWMAN: To tell you that, I would have to look at what they were actually doing for it.

MEMBER STETKAR: I think what you're describing would be analogous to what they're calling a path 2 assessment.

MEMBER RAY: That's what I thought.

MEMBER STETKAR: You're protecting feasibility, but it's protection, not mitigation. You're not mitigating damage. You're preventing damage and that's analogous to their orange box path 2.

MEMBER RAY: Yes. I withdrew the word mitigating. That's a misnomer. But anyway, it looks like some of this and path 2 I thought was most like it.

MEMBER STETKAR: In my mind, that's the analogy.

MR. BOWMAN: It's a little bit of a difficult thing to give you a certain answer to

because we have licensees that as part of their response to the mitigating strategies order installed capabilities that are new capabilities that are only relied on for the flex mitigating strategies.

One of the licensees that comes to mind readily would be South Texas where they put diesel generators on the roofs of their auxiliary buildings. Those diesel generators are protected from the flooding hazard, but if a licensee were to point to that and say that it's providing flood protection, we would likely call it a mitigation, rather than a protection because it's not the installed plant equipment that reliance is on, although I believe they can already protect against the flooding hazard of that licensee. But it's a complicated question and I didn't want to make the diagram any more complex than it had to be.

MEMBER RAY: I just want to remind those who are involved, we've done something that's not dissimilar from what you're talking about here recently.

MEMBER STETKAR: We need to be a little aware of time because the industry needs some time.

MR. BOWMAN: Okay, bottom line is that although our endorsement of Appendix E to NEI 12-06

only allows for crediting it as demonstrating the feasibility, the outcome of the analyses that a licensee does for it will result in a document that shows that time margins are available for all of the individual actions that are necessary to carry out the mitigating strategies as well as an integrated roll up of all those actions to look for double counting of personnel and equipment and a discussion at a qualitative level on what the effects on the performance shaping factors are.

We believe that the staff will be capable of looking at that validation and making a qualitative judgment using engineering and operational judgment as to whether or not it is adequate to meet the needs of what our qualitative assessment of the flooding risk is for, in this case, path 2, given our knowledge of what the magnitude of the risk is.

For the path 3, the local intense precipitation, as I mentioned before, licensees can approach this hazard using either a demonstration of effective protection or the capability to mitigate the hazard. We have looked at this in the mitigating strategies area and what you see here is the discussion of it as it was proposed to the Commission in COMSECY-15-0019 which had been approved by the

Commission in their SRM

MEMBER STETKAR: In this, I went back and I read the COMSECY and quite honestly, as I read the COMSECY I was given the impression that local intense precipitation would be resolved through protection, because there are examples in there that talk about clearing drains and more realistic evaluation of precipitation rates which sounds an awful lot like path 1 and path 2.

Now you're suddenly getting into a situation well, no, you can mitigate the effects of local intense precipitation that causes damage within the plant and yet that evaluation that pertains to mitigation now will not be subject to staff review in the same way as an integrated assessment of a different flooding hazard, let's say a riverine flood or a coastal flood. And therefore, it won't be subject to potential consideration in phase 2 for regulatory action.

Why exactly is that? Because I don't read that in COMSECY-15-0019. Why is that? Because that was developed before this whole framework was established. Now you have a framework.

MR. SHAMS: I think this goes back to earlier questions about are we recognizing the

interrelation between the green boxes and the blue boxes. And essentially that's us recognizing that given the characteristics of the hazard itself, it's localized over the site itself, given the fact that local, intense precipitation for a site is a bad drain.

So I'm going through just the characteristics of the hazard itself. It's about --

MEMBER STETKAR: I'm sorry, if the river comes to visit me, that's also local to me, so I don't understand why local intense precipitation is any different from riverine or lake front or coastal zone flooding. If the flood came to visit me, regardless of how the flood got here, in this case it rained on my site and in another case it rained 150 miles up the river and the river decided to come visit me, so I don't get that. So go on to the next thing, because we do need to be a little short of time here.

Don't give me a history. I want to understand philosophically why mitigation of a local intense precipitation flooding that causes damage inside the plant, that causes damage inside the plant, is treated from your perspective differently than a riverine flood that causes damage inside the plant, because it's being treated differently.

MR. SHAMS: As I shared simply in our mind was that it's a hazard that's better predicted given our forecasting abilities. It's a hazard that we saw that it's a frequency from some of the information we have out there is too low such that they would not go through backfit. It's a hazard that we in our guidance we still are seeking an appropriate balance between mitigation and protection.

We still have that ability to comment on a licensee's approach and say that's still not the appropriate balance of mitigation and protection. But we feel that this is an appropriate hazard to declare up front that a mitigation process for it is appropriate. And we're being responsive to the Commission that says focus the integrated assessments on hazards that are cliff-edge hazards that have the potential for the safety enhancement. And we did not believe that it would fit in there.

MEMBER STETKAR: So you know the frequency of this is much, much lower than the frequency of the probable maximum precipitation 200 miles away from the site that causes over-topping failure of 6 intervening dams. You know that this is much lower than that.

MR. SHAMS: I wouldn't declare that I know that that --

MEMBER STETKAR: No, you know that because that event that I just described will be subject, if it causes damage in the plant, to a mitigating assessment that goes through path 4 or path 5 and in the subject to your review in phase 2 for possible regulatory action. It will be by definition.

MR. SHAMS: That's true.

MEMBER STETKAR: Okay, thanks. We should go on because we need to -- I needed to get that on the record. We need to go on and get to the other paths.

MR. BOWMAN: Okay, we did include a clarification on local intense precipitation to state that licensee should assess the protection of the key SSCs prior to going on to demonstrating the mitigation capability.

For path 4, the demonstration of effective mitigation, path 4 and path 5 are the two paths that industry has laid out as the revised integrated assessment paths.

In path 4, the clarification that we have made is that licensees should provide information corresponding to the critical flood of elevations or as they've been referred to elsewhere, the consequential floods including the frequencies of

exceedance of those consequential floods. This is an area where we are still working with industry on how that would need to be addressed and we anticipate that we will receive comments from industry on that subject.

For the frequency determinations, for path 4 and path 5, Appendix D of NEI 16-05 provides methodologies by reference that can be used for finding frequencies of exceedance in the range of the 10^{-3} to 10^{-4} area. We've made a few clarifications to the use of the Appendix D methodologies, and we've also provided in enclosure 2 that provides examples of characteristics of a methodology for determining frequencies that when appropriate can be used in conjunction with the Appendix D methodologies.

Path 5 of NEI 16-05 is a scenario-based path that will select a variety of different flood mechanisms at different particular frequencies of occurrence and include -- our clarification is that they should include the same critical flood elevations as one of the scenarios so that we will have the frequencies of exceedance for the consequential flood heights.

The consequential floods heights that I mentioned previously and I'm talking about right now

would be that flood height or flood criteria at which the licensee would no longer be providing protection of the plant, but may be needing to go to mitigation.

This will give us, when we have the information, an indication of where the balance between mitigation and protection that the licensee is proposing is and that will be an input to the path 2 regulatory decision making.

VICE CHAIRMAN CORRADINI: A clarification. You said this now three or four times. The transition between protection and mitigation for some sort of flooding events is protection is I've already got it there and I just watch the event happen and mitigation is I actively have staff do things?

MR. BOWMAN: No.

VICE CHAIRMAN CORRADINI: In your mind, where does that -- how do I put it as a protection versus a mitigation?

MR. BOWMAN: A protection is I have installed structure systems and components, safety related or possibly not safety related that the plant relies on to provide core coolant containment and spent fuel pool cooling.

In the flood protection area, those particular structure systems and components are

protected against the flooding so that the flooding does not affect them.

VICE CHAIRMAN CORRADINI: And they don't require operators to do so.

MR. BOWMAN: They could, because flood protection includes the potential for reliance on temporary flood protection measures that a licensee's operators would need to put in place or activate by some means in order to provide the flood protection.

Flood mitigation would be the use of something different other than the normal plant equipment that's already been looked at and is already relied upon, for example, the use of a flex pump that's provided under the mitigating strategies order or generator to replace the functionality of an installed structure system for component.

VICE CHAIRMAN CORRADINI: So by definition flex is not in category 1 of installed. It's there just in case based on the flex -- to satisfy the rules, so therefore you don't count it in the protection category. You count it in the mitigation category?

MR. BOWMAN: That's correct.

VICE CHAIRMAN CORRADINI: Okay, fine.

MEMBER STETKAR: Eric, one of the things

that you didn't really, we talked a little bit about at the subcommittee meeting, is that if I do a Path 4 now, now that we've introduced the Paths and the distinctions in Path 5, I wanted to bring this up.

If I do a Path 4 assessment, or what I'll call for the moment a higher frequency Path 5 assessment, so I've got a frequency that I've assessed somewhere above 10 to the -4 event per year or thereabouts.

The guidance talks about I have to demonstrate effective mitigation. And there's distinct guidance in terms of effective mitigation of -- having confidence in both the reliability and availability of hardware. Those pumps, for example, that they take credit for. There's a whole appendix in NEI 16-05 that addresses hardware reliability.

If I take the lower frequency Path 5 approach, something that has a low flooding event frequency, the guidance says I have to demonstrate feasibility of the mitigating strategies.

And that, in a general risk informed kind of hierarchy, that makes a lot of sense, that I have to have some confidence that I can indeed achieve for what I intended to achieve.

But at very low frequencies, perhaps, I

don't have to have the same confidence in the reliability of achieving those end points as I do for higher frequency events.

And that's, in the subcommittee meeting we had some discussion about the difference between now using the guidance for human performance, that's focused on demonstration of feasibility, versus guidance for human performance that would give me higher confidence in both feasibility and reliability.

Do you want to comment on that? I know we had some discussion already on the feasibility.

MR. BOWMAN: I can comment on that, and if we go back to where we started out with the where things came from, we will be in the position of having already had a great deal of work done using the NEI 12-06 Appendix E, Guidance for the Development of Demonstration that the manual actions have been feasible.

As I mentioned previously, the outcome of that will be a report that documents the time margins available between the time required to take an action and the time that's available to take an action, for all of the actions in the mitigating strategies.

NEI 16-05 tries to draw a distinction between the reliance on the Appendix E from NEI 12-06

demonstration that the strategies are feasible, and something that's effective by evaluating other aspects of the human performance for those mitigating strategies. We don't really see any true value to be gained in drawing that distinction.

It's a little bit too qualitative a stamp to put on something, to say that it's demonstrating that you've got effective strategies as opposed to feasible strategies.

And what the staff believes is possible to accomplish is make a qualitative judgment of the degree to which the capability of the licensee to accomplish the strategies relying on the validation that was conducted using the process that's in NEI 12-06 Appendix E as supplemented by NEI 16-05 Appendix C, and use engineering and operational judgment to come to a qualitative determination as to whether that demonstration is adequate to satisfy the needs in order to address the risk that's posed by the flood hazard at that reevaluated hazard level, taking into account our understanding of what the magnitude of that hazard is.

Did that answer your question?

MEMBER STETKAR: I think so. From what I got out of it, make I sure I understood. You're going

to take the results of their integrated assessments, look at them, and make a qualitative judgment about whether or not you think it was effective enough.

MR. BOWMAN: Right. I'm not saying to look to whether they've binned it as being a feasible strategy or an effective strategy. I'm going to look to the underlying validation that was accomplished to see that it was good enough or it was not good enough qualitatively.

MEMBER STETKAR: Okay, thanks.

MR. SHAMS: And thoughts that I can add, it's --

MEMBER STETKAR: We don't have the time to go, we talked quite a bit and it's on the record in the subcommittee meeting about this topic.

I think that it's, I personally think that there are ways to have higher confidence that something is reliable without doing a quantitative human reliability analysis, if you will, and coming up with some quantitative estimate for, you know, the likelihood of failure of an action.

As I said, the hierarchical framework that's been set out makes a lot of sense from a risk-informed, performance-based approach to life, where you ought to have higher confidence that mitigation

strategies for higher frequency events can be accomplished reliably. Compared to, still confidence, but perhaps not the same degree of confidence, of accomplishing mitigation strategies for much lower frequency events.

And I mean, that's sort of the notion of a risk-informed, performance-based approach. And all I was doing is trying to probe the notion of how the staff makes a determination for those higher frequency events, or for events that don't take the frequency approach but just look at the magnitude of the hazard, kind of Path 4 assessment.

How, for those approach, you're going to make the determination that you have reasonable confidence that those mitigation strategies from a human perspective can be achieved reliably.

Because there is distinct guidance about things you need to think about for the equipment. That it's maintained, that it's, you know, tested, that it's got all of those things. There is even guidance on looking up generic failure data to support that notion. Which does get into trying to assess the reliability in terms of failure rates and things.

So it's just, I understand from your answer what you're going to do.

MR. SHAMS: Yeah, I hope we reflected that we understand and that's our intention, is to look at the hazard, to look at the magnitude of the hazard and its frequency, and then adjust from there. But we had to establish an acceptable baseline which is at feasible human actions, and then we'll go from there as Phase 2 proceeds and we decide we need more than that.

MR. BOWMAN: One thing that I didn't mention at the outset of the presentation is that the initial set of guidance that went out in JLV/ISG 2012-05 for the integrated assessments is not being withdrawn, and it may be relied upon by licensees.

That guidance includes an appendix, Appendix C, that closely parallels and is based upon the Reg 1852 for the determination of feasibility and reliability.

And it may be a path that we need to go down later on requesting further information or demanding further information if we get to a position where we need a greater assurance of reliability for actions than we believe we've achieved by licensees' execution of the validation using the current guidance.

MEMBER STETKAR: There's one more topic,

and again, I have to make sure we have time for the industry, that we did discuss during the subcommittee meeting. And I noticed in your presentation you have a backup slide that addresses it.

And that is, as I read all of the guidance, and I think we had a discussion at the subcommittee, the guidance in NEI 16-05 does say, for example, I need in my assessment -- I tend to use the words poorly. So when I think about hazards for my site, one of the hazards that I need to think about, for example, let's take a riverine site, is a seismic event, for example, that fails an upstream dam, from upsite.

Okay, and that's listed. NEI 12-06 also explicitly tells me that I need to consider seismic failures of downstream dams that might drain my ultimate heat sink. So it's clear that either taking the water away or putting water on my site, I have to think about seismic events.

The guidance, and we were told this orally, the guidance in some places, tells me that I do not need to consider coincident hazards.

So, for example, I do not need to consider the effects of an external flood at my site that's caused by a seismic event that had an epicenter close

enough to my site that failed an upstream dam and also affected my site. And those, we were told, are explicitly not considered.

And part of the concerns that we had were, as people developed these more focused scenario-based strategies for protecting, either protecting the plant or more particular, developing mitigating strategies where people are talking about housing the mitigation equipment in structures that are robust for seismic events, but may not be protected against flooding.

But you can move that equipment for a flood event. Other equipment might be protected against that flood event, but it might not be robust for seismic events.

There's a concern that you can get into situations that, should you have seismic damage with an external flood that's a direct consequence from that seismic, not an independent type of thing, that focused mitigation strategies may not adequately account for that.

And that these integrated assessments now, because we're talking about mitigation, may not recognize those conditions. And therefore, the staff's evaluations may not recognize those conditions.

Can you talk a little bit about that? And I know you came prepared to do that, so I'd say go.

MR. BOWMAN: Yes, we can. As we mentioned during the subcommittee, there are a couple of sections in NEI 12-06 that do allow for the consideration of consequential failures. Those are in Section 3213, and I think it was Item No. 9, and 3214, Item No. 4, that set the initial conditions and the boundary conditions for the analyses and the evaluations that were done for developing the mitigating strategies.

We discussed the review, to a certain extent, in an internal memo on supplementary staff guidance to the Mitigating Strategies Directorate when it was stood up in 2013. I can provide a copy of the memo to Mike Snodderly for the committee's review, if you like. It was made public and it does talk to consequential events are within the scope of the mitigating strategies.

It was unfortunate that the individuals from industry that were present for the subcommittee meeting were not licensees for whom a coupled seismic and flooding event would have been in scope.

I know of several licensees that have addressed the potential for coupled seismic and

flooding events, and they did address them by providing both seismic and flooding protection against the, or for the mitigating strategies, and then against both hazards at the same time.

In addition to that, the flooding reevaluations under NTTF Recommendation 2.1 looked to seismic dam failures, and seismic dam failures will be further addressed in the seismic probabilistic risk assessments. It's within the scope of the SPRAs for things that are to be looked at for what the results of a seismic event.

MEMBER RAY: We don't have time to get into it, but when you say dam figures, always include tsunami also, would you, where that's applicable. Because I think that's your intent, isn't it?

MR. BOWMAN: It is. Seismic and flooding coupled. We don't have that many licensees that are subject to tsunamis.

MEMBER RAY: That's correct, but there are some.

MR. BOWMAN: Oh, yeah.

MEMBER RAY: So I just, and that's not as well developed. Like I said, I don't want to take time, because we're out of time.

MEMBER STETKAR: We do need to move on.

For the record, I'd like to quote, because you pointed me to two sections of NEI 12-06. So 3213 No. 9 says no additional events or failures are assumed to occur immediately prior or during the event, including security events. So that doesn't tell me that I have to look at consequential things.

And 3.2.1.4 No. 4 says no independent failures, other than those causing the loss of alternate heat sink, and that are assumed to occur in the course of the transient.

Now, everybody's been interpreting that as I don't need to consider two what I call independent events, a seismic and a flood. So I just wanted to get that on the record of the points that you said explicitly tells me to look at consequential events, because I don't read that that way.

MR. BOWEN: And in any case, it is definitely a recommendation we would take from the committee on the Regulatory Guide 1.226, which will be the outcome of Draft Guide 1301, which we'll be briefing you on in the future when we get to the final series.

(Simultaneous speaking.)

MR. SHAMS: Two seconds. I'd like to walk away with that it is not lost on us, it is not lost on

the sites, that this is an issue for them. A coupled seismic and flooding event in both areas.

In 2.1, as we laid out, that that's been looked at. And the entire 2.1 is about ensuring that the plant survives the seismic event and as the flood comes, this entire evaluation here is making sure that they have either protection or mitigation for the flooding.

In terms of mitigating strategies, our last bullet actually addresses that directly. Yes, the guidance could have been more explicit. But those sites that understand in their design basis that they could have a coupled event did clearly looked at it, whether or not the guidance led them to do that.

MEMBER STETKAR: Good, I'm glad to hear that. Anything more, because we want to try a little bit on time here. Anything more for the staff?

If not, thanks a lot, covered a lot of ground. Really appreciate the front walk-through on how we got here. Let's bring up the industry, because I know the industry has some comments on the guidance. Admiring comments, hopefully.

Tom, you taking the lead, or is Mike?

MR. ZACHARIAH: I'm going to take the lead. This is Tom Zachariah, NEI. Good morning. So,

we're going to skip over a couple of slides, since we went over in detail and we're struggling with time.

There's a bunch of clarifications that I generally make whenever I make this presentation which were already made. The one thing I do want to clarify, just so we're all on the same page, is that the way the paths will work through the flowchart is that it's taken mechanism by mechanism. So there might be a site that has multiple mechanisms, so they may be on multiple paths.

MEMBER STETKAR: But for the purpose of the committee and the record, a flooding mechanism is a source of flooding. So a riverine flood is a flooding mechanism, a local intense precipitation event is a flooding mechanism.

MR. ZACHARIAH: Yeah, thank you, appreciate that.

MEMBER STETKAR: It's jargon, but sometimes on the public record, it's good to get past the jargon.

MR. ZACHARIAH: Appreciate it. So before we get into the comments that we're going to be presenting, I want to point out that we feel positive towards the ISG that the NRC staff developed. In general, we think it is hitting the areas that we need

to.

We will be providing comments on it. The majority of those comments will be clarifications and discussions over wording. There are a few things that we feel strongly about that we will point out.

And the first one is mainly in the integrated assessment, this Path 4. And we developed two paths within NEI 16-05 that address the integrated assessment, the first being Path 4, Effective Flood Mitigation, and second being a blended approach for Path 5.

So the reason we were very intentional in developing this and the difference between the two, the main difference between the two, is in Path 4, we intended that the utilities or licensees would not develop site-specific frequency development. As we felt that there are certain mechanisms, for example dam failure, where that would be very difficult to do.

The ISG clarification on Path 4 essentially adds back that element of the frequency of exceendance in developing that for the critical flood elevations. Yeah, our issue with this is a level of complexity.

So for frequency development, precipitation in river-type mechanisms, we feel that

for the more likely situations or frequencies for floods, it's a simpler evaluation, I shouldn't call it simple, but it's a simpler evaluation, to determine what the overall frequency for those situations are.

However, with the higher complexity situations where there are dam failures, and really this would be a very large effort, it would be a large-scale effort, there's a lack of accepted methodologies. And when the utility doesn't own the dam, it's very difficult to get to the information that they need to get to.

And when this is a large effort, and essentially building a PRA model for a dam, that access to information and data is very, very critical. And we feel that adding this clarification into the ISG defeats the purpose of having the distinct distinguishing between the two paths. We felt that basically makes Path 4 and Path 5 the same.

MR. BELLINI: It's my understanding that the Corps is in fact -- I got it. That the Corps is in effect or has done analysis of dam failures for the licensees already.

MR. TSCHILTZ: In some cases, yeah, that's my understanding.

MR. BELLINI: Where they have

jurisdiction. So the lack of access to dam information from USACE is --

MR. TSCHILTZ: Well, to come up with a likelihood is still a challenge though, I believe. I don't think they're necessarily doing that. You know, the lack of accepted methods, the number of mechanisms by which the dams can build make it a very complicated type of analysis.

The fact that there's different types of dams out there, some of which are earthen dams, there's a number of different parameters that need to be considered in the determination of the likelihood of flood.

And I think we feel that to go down this path with the staff, it would be a research project. It's not an integrated assessment at that point. It would be very complex, it would involve a number of different iterations, and it wouldn't allow a timely response as far as developing an integrated assessment.

And we have Joe Bellini, who represents Exelon, on the phone, who can comment on dam failure mechanisms as well, if you can open up the line for him.

VICE CHAIRMAN CORRADINI: While they're

opening up the line, let me just make sure I understand the final bullet. So your point is, given the complexity under these various upstream dam effects, that 4 and 5 are literally the same thing.

MR. ZACHARIAH: Yes.

VICE CHAIRMAN CORRADINI: And they're the same thing because I don't know the frequency but I can understand the potential impact when I do a conservative calculation? I'm still not there,

MR. ZACHARIAH: So what makes them different in 16-05 is that in Path 4, you would identify the critical flood elevations, but you wouldn't have to determine what the frequency for each, for those scenarios. You would establish that you have effective flood mitigation for all of the critical flood elevations.

VICE CHAIRMAN CORRADINI: In 4?

MR. ZACHARIAH: In 4. In Path 5, you would distinguish the critical flood elevations, determine the level of likelihood between those critical flood elevations, and depending on that evaluation, you would determine what the appropriate level of response is required.

So it may be a blend, so for the more likely, it may be a blend of effective protection and

effective mitigation. And with the less likely floods, we would be pointing back to NEI 12-06 for the feasible response.

MR. BELLINI: It's my understanding also that the Corps is embarking at some point on a ---

MEMBER STETKAR: We ought not to speculate on what the corps may or may not be doing. Okay.

MEMBER BROWN: So finish, John, I'm sorry. I just had a question myself. I have a little difficulty with the higher complexity approach by saying this is just too hard.

I mean, it's almost similar to me and from the standpoint of looking at the Daichi plants that kind of brushed aside the fact that this has been any induced tsunami and flood would completely flood, overdo their complete plants and wipe them out, because it was very, very, very, very, very, very unlikely. And it's a big, bad thing.

And here you've got a very high value asset that's sitting downstream of a major dam or whatever size dam whose complete failure would bury it. I just had a hard time with not, with looking at this thing was just too hard, so the likelihood is too hard to figure out, so therefore we'll do nothing.

MR. TSCHILTZ: So I think one comment I

would make is that I think you're not recognizing the fact that plants have demonstrated effective mitigation for those type of events. Those strategies exist. So the question now becomes whether you need more protection, or whether effective mitigation is enough.

So for these type of Path 4 plants, I guess we're trying to distinguish that they have more rigor that was done in the mitigating strategies assessment using Path 4 in determining effective response than what was done.

So you have your mitigating strategies to demonstrate it protects against this mechanism, plus what we do to determine the effectiveness of the response.

And let me just comment on that too, because there was a dialog on this during the staff's presentation about whether or not what's done, I think it's in Appendix Charlie for looking at the effectiveness of the actions.

At this point, we know more than what we would have known during the mitigating strategy assessment. We'll know when the time line for exceeding the critical flood elevations, we'll be able to more effectively review the site response to that

mechanism.

We'll also be looking at the overall strategy of the site and whether there's resources and command and control that's appropriate for that even established. So I would take exception with the statement that it doesn't do anything more than the feasibility assessment that was done for the MSA. We think it does, or else we wouldn't have suggested that we do it.

MR. ZACHARIAH: Just to add on to one thing Mike said, that we're responding to, it's not that the Path 4 sites wouldn't be doing anything. They would have the burden of having to demonstrate that they have the highest rigor of mitigation for all, for the entire probable maximum flood for that entire mechanism.

They don't have the benefit of making an argument of frequency that, okay, for only these frequencies, I need to have this level rigor. And for these frequency floods, I have something a little bit less. So it's not doing nothing, so I would take --

MEMBER BROWN: If I take your response, I would read it as saying we can provide a -- they're required to provide mitigation for the worst, for the entire dam failing totally in a huge way, potentially

inundating the site. Is that correct? So you could mitigate it.

MR. ZACHARIAH: Yes.

MEMBER BROWN: So you can watch it come and pile up the sand bags, or erect your barriers or whatever's done, the mitigation strategy is what --

(Simultaneous speaking)

MEMBER RICCARDELLA: Then if you can't do that, then you go to Path 5, correct? And then --

MR. TSCHILTZ: Path 5 still has mitigation. There's still --

MEMBER RICCARDELLA: I understand that, but if you can't show that you can do it all the way up, that you can take whatever might possibly happen, that's Path 4, then you can look at Path 5 and say, well, now I can look at the frequency. And if the frequency of the things I can't survive is sufficiently low, then I'm okay. Right? Is that the difference between Path 4 and Path 5?

MR. ZACHARIAH: That is correct.

MEMBER BROWN: That wouldn't have worked at Fukushima, I guess then.

MR. TSCHILTZ: I take exception with that. They've demonstrated effective mitigation for the sites where the dam failure's an issue. That to me

means Fukushima wouldn't happen at that site, based upon the response to those events. But I want to give Joe Bellini a chance to talk.

MEMBER STETKAR: Let's get Joe, because we do have to kind of stick to the agenda a bit here.

MR. TSCHILTZ: Go ahead, Joe.

MR. BELLINI: Yeah, I just wanted to step back and comment on the Corps of Engineers' involvement in their assessments of their own dams. You know, it's my understanding that serves for certain sites where they have a Corps of Engineers upstream dams.

They performed a deterministic look at the dam's specific PMF and the dam's ability to withstand that PMF, and a seismic event, and made a determination as to whether a dam would fail or not.

And then did the hydraulic analysis on the failure that provided the flows at the plant as a result of failure for those dams that they didn't have a high confidence would withstand those initiating events. It's my understanding that they did not use probabilistic characterizations to make those decisions.

A lot of the details for that was done behind the scenes within the Corps of Engineers

organization. But it remained in deterministic state. So that dams where there's an issue, it would be an extra bit of effort to go into more of a probabilistic characterization of those failures.

MEMBER STETKAR: Thanks, Joe. This is John Stetkar. And just for the record, people have been talking about the Corps of Engineers as if the Corps of Engineers controls every upstream dam from every nuclear power plant. That is not correct. The Corps of Engineers has done assessments for a selected set of plants where they actually operate and control those dams.

There are many other plants that are not subject to Corps of Engineers' dams, and this guidance applies for all the plants in the country. So we should not focus on what the Army Corps of Engineers does or doesn't do, because they're only one part of the whole equation here.

I just wanted to make sure we get that on the public record, because I didn't want to get the impression that all of the dam failure analyses for every site in the United States are being done by the Corps of Engineers and what they may or may not do in terms of probabilistic sense, so.

Thanks, Joe, thanks very much. Go on with

your presentation.

MR. ZACHARIAH: Yeah, so, we only have two more sites. So the other item that we feel strongly about is this clarification regarding Appendix Delta. Now in 16-05, Appendix Delta is the portion of the guidance that provides a catalog of ways, of methods to estimate the frequencies that are greater than 10 to the fourth per year scenario.

So, it's the second part of the clarification that we take issue with is, when applying these methods, the licensee should consider the attributes described in Enclosure 2 of the ISG. Now Enclosure 2 provides a high level overview guidance for a PFHA, which is not required for the flooding assessment as described in the NEI guidance, and even the ISG I think recognizes this is not necessary.

So though we understand that the staff believes that it's not a requirement, including Enclosure 2 in the ISG causes confusion, as the attributes that are to be addressed and how to address them haven't really been described.

And the other issue with Enclosure 2 is the implementation of peer reviews. We feel that will prove difficult to accomplish. Anyone that's been in

the PRA realm can probably speak to that. There's limited flood experts out there in the industry, there's a lack of a peer review process, there's a lack of a standard that we could point to and use in the process, which would, we feel that this would be a huge effort.

MEMBER STETKAR: Thank you. Any questions for the industry? Sorry to rush you a little bit, there's a lot of stuff here, I know, so. I think you got everything in? I want to make sure that you did indeed get a chance to make all the points you wanted to.

MR. ZACHARIAH: Yes.

MEMBER STETKAR: We really appreciate the feedback. If nothing more for the industry, I'd like to ask if there's anyone in the room who'd like to make a comment. If you would, please come up to the microphone, identify yourself and do so.

And I know we have the external line open, so if there's anyone on the external bridge line who would like to make a comment, please identify yourself and do so.

Joe, if you're still out there, just say hello. I'm pretty sure it's still open.

MR. BELLINI: Yes, I'm still on. So I can

hear you.

MEMBER STETKAR: That's fine, I just wanted to make sure it's open. If no public comments on the bridge line, I'll turn it back to you, Mr. Chairman.

CHAIRMAN BLEY: Thank you, Mr. Stetkar. At this time, we will recess for 15 minutes, and we'll return at 10:20 to take up the topic of Fukushima Tier 2 Group 3 recommendations on other natural hazards. We'll recess.

(Whereupon, the above-entitled matter went off the record at 10:05 a.m. and resumed 10:21 a.m.)

CHAIRMAN BLEY: We are back in session. At this point, I will turn the meeting over to Mr. Stetkar once again, this time to look at the Fukushima issue. John.

MEMBER STETKAR: Thank you, Mr. Chairman. It seems so long since I headed one of these sessions. This next topic is -- we're going to switch gears a little bit. It is the staff briefing us on their interim progress on screening out other external hazards not being seismic and external flooding. I'm sure the staff will walk us into, again, what we're talking about. Without cutting more into their time,

I'll turn it over to Joe or Mo --

(Simultaneous speaking).

MR. SHAMS: A quick start. I'll use my introduction just to --

(Simultaneous speaking)

-- lay out a quick roadmap for you. As Dr. Stetkar mentioned, we're discussing with you today our interim product to the Commission related to our assessment of other natural hazards, other than flooding and seismic. Essentially, we know what we're doing in flooding and seismic's 50.54(f) letters, collecting information, and seeing responses. We needed to answer the same question, given your recommendations and giving Appropriation Act directions for us, so this process, we laid out for the Commission how to look at the other hazards, other than flooding and seismic, and how to ultimately make a recommendation to the Commission on whether or not any additional regulatory actions are necessary. Today, we're presenting to you our interim report to the Commission, our interim SECY paper. Basically, you'll see that we'll be concluding that for most hazards in most plants, other natural hazards do not -- we don't foresee them needing any regulatory actions, and we'll discuss with you the rationale

behind that conclusion.

We would also let you know that for high wind, particularly hurricane, and for snow, we believe that some plants would benefit from additional -- we would benefit, certainly, from additional studies in these two hazards, and we will be doing that in the next few months and, ultimately, reporting to the Commission, again, whether we need any further regulatory actions or we recommend no additional actions. With that, I'll turn it to Joe to walk us through our assessments and our conclusions.

MR. SEBROSKY: Good morning. My name is Joe Sebrosky, and I work in Japan Lessons Learned division, in Mohamed's branch. This slide is just a summary of how this particular item fits into the broader Tier 2 and Tier 3 activities, which we've previously briefed the ACRS on. That culminated in a SECY paper that was issued in October, SECY 15-0137, October of last year, that had a listing of all the Tier 2 and Tier 3 activities. What that SECY did is it grouped the various Tier 2 and Tier 3 activities into three different groups. Group 1 was issues that the staff was recommending closure.

Group 2, the staff thought it had enough information to close out the issue, but it would

benefit from additional interactions. Then Group 3, where the staff just provided a high-level process for how it was going to address the Group 3 activities. For all the Group 3 activities, the staff's statement in SECY 15-0137 was it was targeting the end of December 2016 to provide an updated assessment to the Commission.

The Commission responded in an SRN to SECY 15-0137, asking for an interim status on this particular history other than the issue being natural hazards other than seismic and flooding. So it separated out the Group 3 issues. This was the only Group 3 issue that the Commission directed the staff to provide an interim product, which is the reason that we're here. With specificity, we laid out a four-step process that we'll talk about here in a little bit, and the Commission wanted the status to include the assessment results through Step 2 of that SECY paper. Next slide, please. To meet the Commission direction, we undertook several activities, including issuing a white paper with the staff's preliminary assessment in March of 2016.

We had a Category 3 public meeting in early April, and then we met with the Fukushima Subcommittee on April 21st. There were three

high-level action items that we took from that meeting. Provide an updated assessment reflecting additional changes -- what we briefed the subcommittee on at the time was that we were making additional changes mainly to the low water level assessments based on stakeholder comments that we had received.

The subcommittee requested that we provide those updates to those draft assessments. We did that on an April 26 letter. That letter transmitted the current draft version of the SECY paper, and also showed a redline/strikeout of the differences between the version that existed at the time we sent the letter to you and the March 24th version. Since that time, we're still responding to comments and including comments that we received at the April 21st subcommittee meeting. We do have a slide that we'll talk about a little later, very high level, to provide one slide on NRC's activities relative to geomagnetic storms or geomagnetic disturbances. There were several items that were provided by the ACRS subcommittee members during the meeting for our consideration on the paper. We'll talk about those in a little bit and how we plan to capture those.

The staff is still on target for providing an updated interim assessment by the end of May and a

final assessment by the end of December. Throughout the process, we have public comments that we receive, stakeholder comments, internal stakeholders, and also the ACRS from the subcommittee meeting. The next two slides show the 12 non-editorial comments that we received that we're addressing.

Right now, the vision is that there would be an appendix that would be added to the document, Appendix D, that would list these items -- this is a shorthand description -- and then show a proposed disposition for each one of them. In some cases, it will result in changes to the staff's assessment; in others, it will point to it potentially being outside the scope of the paper. But regardless, each one of the issues will be described, and a resolution will be described. Right now, we're thinking that will be in Appendix D, with specificity. If you look at the first five items here, we were aware of these first five items before we talked to the subcommittee. We briefed the subcommittee on what we were doing about Item 4 and 5. Those were the low water level evaluations, and that resulted in us sending the ACRS an update at the end of April, showing where those major changes were that we were considering as a result of those comments. Starting with Item 6 --

VICE CHAIRMAN CORRADINI: Could I ask you about 4 and 5? I guess -- again, I wasn't there, so low water level where?

MR. SEBROSKY: The low water level evaluation that's in the SECY paper is not -- the issue, when you look at Appendix B of the paper, is is there something that could potentially fall outside of the flood hazard re-evaluation report that licensees are doing? One of the things that --

MEMBER STETKAR: Joe, I think he's asking a more basic question, low water in what?

MR. SEBROSKY: So it's low water in the ultimate heat sink, and it's based --

VICE CHAIRMAN CORRADINI: Versus 6, where it just is gone.

MR. SEBROSKY: No. Yes. I was getting Item 4 and 6 confused.

VICE CHAIRMAN CORRADINI: So 4, 5, and 6 are all for the same location, I guess, is what I was trying to get at.

MR. SEBROSKY: That's correct; the location being the plant. Item 6 is asterisked. That's our shorthand for there's a longer description contemplated for Appendix D, but that's the shorthand that we took from the ACRS Subcommittee meeting. If

you go to the next slide, all the items on this slide also came from the subcommittee meeting. As I indicated, in some cases, it's going to result in a change to the assessment. For example, Item No. 7, we will be updating -- Appendix A is where we have a discussion about volcanic ash at Columbia.

We will be providing additional information about Columbia's capabilities and the assumptions that it made, relative to by-products of volcano, both for the design basis of that, and for the FLEX department. Just as an example, that item would have a disposition that changes were made to Appendix A. Here's the issue, and these were the changes that were made. Next slide.

VICE CHAIRMAN CORRADINI: Can I ask -- you'd have to go back to the list. These will be all considered as items independent of frequency, or is there a frequency cutoff -- sorry, I used the wrong word. I'm sure I'll get chastised. Is there a probably estimate cutoff that certain things are just a low enough probability I'm not going to concern myself with them?

MR. SEBROSKY: When you look at Appendix A of the document that talks about the hazards, we are talking about hazards that are beyond design basis

events, some of which don't lend themselves to probability. There is an example in there that meteorites, for example, were screened out because of the probability. But for the most part, it's a qualitative discussion that the staff provides as a basis for either screening a hazard in for additional assessment, or screening out in the first step.

VICE CHAIRMAN CORRADINI: And then you said since --

PARTICIPANT: Microphone, please.

VICE CHAIRMAN CORRADINI: Sorry. It didn't go green fast enough. I'm sorry. As natural hazards, and the probability is hard to get a handle on it, are some of these so general that they affect the general infrastructure, just not the plant? The geomagnetic storm one is the one that pops in my head, but that's a different category?

MR. SEBROSKY: It is. We have a separate slide on the geomagnetic disturbances. There's certainly issues like volcanoes, where you can say broadly --

VICE CHAIRMAN CORRADINI: I might want to go to the nuclear plan because it's the safest place to be?

MR. SEBROSKY: Yes. There's only plant

that we called down that needs additional assessments.

MR. SHAMS: All I wanted to add is to the extent that we can calculate these event frequencies, we include them in the assessments. We did that for tornado. We're doing it for hurricane. When it's difficult, as Joe is indicating, we try to qualitatively look at the overall picture. Are we talking about entire infrastructure of a state is gone already, or half the country? We factored in in our qualitative assessment.

VICE CHAIRMAN CORRADINI: Okay. So there was some binning based on estimates of probability, although hard to get a number?

MR. SHAMS: To the extent that we could, yes.

MR. SEBROSKY: Slide 6 shows the four-step process. This was the four steps -- if you go back to SECY 15-0137, when we talked to the ACRS last year, that culminated in the paper in October, Enclosure 1 is where evaluation of natural hazards was housed. It was very short. It was only six pages, compared to some of the other evaluations that were quite more substantial.

This process was a process that we outlined to the Commission that we would undertake to

assess natural hazards other than seismic and flooding. The first was to define the hazards that we're considering. The second was to apply screening criteria to exclude some of those hazards on a generic basis. If we could not do that on a generic basis or it warranted additional technical evaluation, we moved to Task 3.

Task 3, when we looked at -- when you look at the paper, we've completed through Task 2 for the white paper. Task 3 and 4 are something that we're targeting to provide the Commission by the end of the year. What we'll be talking about in future slides is how some of these hazards screen out at the first two tasks, and how some of them go on to Task 3 and Task 4. When we're looking at Task 3, one of the things that will be considered as part of Task 3 is whether or not we have a basis for issuing a 50.54(f) letter, or if it's so safety significant that we would issue an order, without issuing a 50.54(f) letter. There isn't anything that we've seen right now that warrants, from our perspective, an immediate safety concern. We think we have time. Of course, if something comes up during the evaluation of Task 3, we're not going to wait for the paper.

We'll engage management and take the

appropriate steps. Task 4 is if we do issue a 50.54(f) letter and get information, Task 4 is very similar to Phase 2 of the flooding and seismic re-evaluations. You get the information, and then you make a determination on whether or not additional regulatory actions are needed. Next slide. This is just a high-level result of Task 1.

These are the kinds of hazards that were considered, and in some cases, what you see in Appendix A is a short description on why we believe the issue can be screened out at Step 1 of the process. There's asterisks here on four items, two of which, the external flooding and seismic activity, the basis for them being screened out is the flood hazard re-evaluations that are being done in accordance with the March 12th 50.54(f) letter for those items. When you look at geomagnetic storms or geomagnetic disturbances and volcanic activity, there's a double asterisk on those. There is additional justification in the text of Appendix A when it comes to those items. The next slide, if you could go to that, talk about geomagnetic storms. The geomagnetic storms or geomagnetic disturbances had a unique disposition.

Its disposition was essentially an argument that it is not a Task 2 activity, that right

now, it's being captured as part of Task 1. When I say it's being captured as not Task 1, it's being captured as part of Tier 1 activities. The mitigation of beyond design basis event rulemaking discusses geomagnetic disturbances and references a petition for rulemaking on this very issue.

When we issued the proposed rule for mitigation of beyond design basis events, we referenced this petition for rulemaking, and the staff received several comments in response to the proposed rule that we're in the process of assessing. The argument for geomagnetic disturbances, when it comes to this paper, natural hazards other than flooding and seismic, is there's two other processes within the NRC that are evaluating this issue, and there's a mechanism for informing the Commission of the results. With specificity, it's the MBDBE rulemaking, and also the petition for rulemaking, the 50-96.

VICE CHAIRMAN CORRADINI: I'm sure the subcommittee discussed -- mechanistically, something occurs naturally that then fouls up the electrical controls within the plant?

MR. SEBROSKY: Yes. The issue is depending on the significance of the event -- and what you see in Appendix A of the paper is a high-level

discussion of what the issue is and why we don't believe there's an immediate safety concern. But nevertheless, there is a concern that's being followed. The issue, from a high-level perspective, is that the geomagnetic storm could result in a disturbance on the planet such that you use off-site power, potentially damage safety-related equipment, and cause a problem to the plant. That's the concern.

VICE CHAIRMAN CORRADINI: There's no current IEEE standards for any sort of pulse like this already for electrical equipment?

MR. SEBROSKY: So what's discussed and understand, I am not an expert on geomagnetic storms, so --

VICE CHAIRMAN CORRADINI: No, I'm just curious.

MR. SEBROSKY: The issue, when you look at the bullet on other federal activities, this issue is broader than the Nuclear Regulatory Commission. The federal family is looking at it. The Federal Energy Regulatory Commission issued a proposed rulemaking last year on how to protect the national grid from geomagnetic disturbances. I'll look to Eric Bowman if I misstate this.

One of the challenges that the NRC has

when it comes to addressing this issue is first, identify what frequency and what level of disturbance you're talking about, what other federal agencies, such as the Federal Energy Regulatory Commission, is doing to protect the grid, and if there's any gaps, what the NRC has to do to protect the plant. It's difficult. Our MBDBE rulemaking is going to be informed by what FERC is doing. The response to the petition is also going to be informed. Did I accurately characterize that?

MR. BOWMAN: This is Eric Bowman. Again, I'm a special advisor in the Japan Lessons Learned division. To the extent that a potential geomagnetic disturbance causes damage within the plant, the rulemaking and the current mitigation strategies order addresses, in part, the concerns that are expressed by PRM 50-96. Where it doesn't completely address PRM 50-96 is looking to the potential for a large, widespread effect over a long period of time on the national grid that results in a loss of off-site power and difficulties in resupplying all of the sites in the nation, rather than just a single site.

We'll be looking at the issues in PRM 50-96 that pertain to that later on, after the actions that are going on with the rulemaking by FERC and the

actions by the Space Weather Operations Research and Mitigation Task Force, which is a national task force being led by the White House Office of Science and Technology programs, as it gets further along in their actions. But we are following through on the geomagnetic disturbances, and it will continue to be followed through under the PRM, rather than the rulemaking.

MEMBER SKILLMAN: I would like to make a comment here. This is not an imaginary issue. Those who have been at the plants know that when there are solar flares, the transformers will react, and react very strongly, and the higher potential, the greater electrical induction, the more reaction you will see. It affects the VARs, the volt act and reactive, that affect how the plants balance the grid. So this is very real. The outcome can be severe transformer overheating or separation from the grid as a consequence of the disturbance. Like Eric said, this can be an event that leads to widespread loss of the grid.

VICE CHAIRMAN CORRADINI: I think I understand that part. I'm more curious about if , now I've separated from the grid, what does this magnetic storm do to equipment, and is there IEEE standards

that at least they ought to be capable of standing something, and this something is higher than the standard? You see what I'm asking?

MR. SEBROSKY: The argument that's in the white paper is the staff looked at a nuclear power plant in response to a congressional inquiry and drew a circle around the nuclear power plant. One of the things that the staff looked at was diesel generators. If you do separate from the grid, what's the potential for that geomagnetic disturbance to damage the diesel generators?

There was some thought that because they're protected behind concrete and would not normally be running that they should be okay. What the issue is, if you have the broader blackout that lasts for a while, you need the diesel generators to be resupplied with diesel fuel oil. Just because the nuclear power plant rides out the geomagnetic disturbance doesn't necessarily mean that the plant's okay indefinitely.

MEMBER BROWN: Concrete doesn't necessarily protect you from an EMP or geomagnetic pulse or storm that you have to deal with. It's shielding and other type things that'll protect you from that.

MEMBER SKILLMAN: It's also everything that is riding with inductive energy.

MEMBER BROWN: It comes down to a lot of different things.

(Simultaneous speaking)

MEMBER SKILLMAN: -- telephone system; it's communications; it's --

(Simultaneous speaking).

MEMBER BROWN: The Navy faced this some years ago. We had to end up isolating all of the connections. Anything that went above the main deck you had to shield -- ground to ensure that not just an EMP, but any other type major electromagnetic interference wouldn't be coupled into the electric plant, which then couples into the control systems, which then shuts down the systems that allow you to steer the ship or control it or make it go up and down or shut down the plants. For the nuclear power plants, it's a matter of coupling into the plant. If you've got open cables that are not shielded, that couple in, and they're not probably grounded, yes, you can get stuff coupled -- won't just affect the transformers, which is a major problem, but can also take out all your controls.

It can also take out systems that a little

-- fiber optics isolates this stuff pretty well from some standpoints, but if you've got any wiring-type couple stuff going into the plants that goes into your control systems for the reactor plant, then you've got -- on the older plants, that would have been an issue. On the newer plants, you have a little bit less of that. Communications are the next item. You can lose all communications outside the plant because that's all RF stuff. It's a fairly big deal. It's just a matter of how you characterize it.

MR. SHAMS: We certainly -- I'll just take one second to sort of frame this slide. We put this slide up just to provide the logic for why, in our activity related to Tier 2 and Tier 3 recommendations, we're recommending the closure of this activity just in that track, but to give you reassurance that it is tracked, and it tracked with focus from the staff in other activities that we're working on. We understand the interconnection of this activity between the nuclear plant and the rest of the critical infrastructure for the country. We just wanted to relay that we're tracking it. We're following. We have other activities that have taken place recognizing the importance of the activity. This is just for that reason.

MR. SEBROSKY: One other real quick thing I'll offer is -- Eric already talked about this -- the White House Office of Science and Technology Policy leading the effort on a national space weather strategy. We, the NRC, have representatives on that task force. The individual that's on that task force is a senior executive service member, and it's Jim Anderson.

He was not available to come over here this morning. He's at a site. He will be back here in headquarters this afternoon, and he indicated that if any member wants to talk to him about it, he can come back over and let you know what that activity encompasses. It is very much on the front end. There was these two important papers that were issued in October, but there isn't anything right now that the NRC has an action on. I'll just look to Cathy, if any member wants to take Jim up on his offer, to make sure Jim's back over here. Slide No. 9, this is just the results of Step 1 of the process. The proposal in the white paper has all the hazards, with the exception of these listed on this slide, would screen out at Step 1. That's high winds from tornadoes and hurricanes, snow loads for roof designs, drought and other low water conditions, and extreme temperatures.

Those were the four things that moved on to Step 2. This is a slide with the preliminary results of Step 2. When you look at the white paper, you'll note that we moved the wind and snow loads right to Step 3. There's a paragraph that says we need to do more of an evaluation. We did, in the white paper, propose dispositioning low water conditions and extreme temperatures as part of Step 2.

Next slide. There were three low water conditions that were evaluated as part of Step 2, drought, low water conditions due to a downstream dam failure -- this is the Robinson item that was alluded to in the earlier slide. The premise here we'll talk about in a little bit, but it is what happens if you have a sunny day failure of a robust dam. Non-robust dams failing, downstream dams failing, are captured as part of the mitigating strategies. The issue was mitigating strategies did not assess -- it fundamentally assumed that robust, seismically designed dams would not fail. For the natural hazards other than flooding and seismic, we looked at that. Low water conditions due to a seiche, there's a similar logic there that the flood hazard re-evaluations looked at high water levels due to a seiche, but did not assess low water.

MEMBER SKILLMAN: Joe, let me ask a question about low water conditions with a tsunami. In several tsunamis that I'm aware of, the incoming wall of water has been preceded by a fairly extended -- extended in terms of time -- extremely low water level, to where the ocean or the body has pulled out to sea 16, 20, 30 feet of elevation, and that condition has persisted for a couple hours -- 3, 4, 6 hours -- and then that water returns as a plate of water that is the tsunami. How, or was, that tsunami low water considered?

MR. SEBROSKY: We do not have a description in the white paper on that. It was based on discussions that we had with a hydrologist in our NRO's division of siting and environmental assessment. The discussions with the hydrologist were the coastal plans in the United States are not susceptible to that condition, so that's why it wasn't evaluated. There is not an explicit statement in the paper, though. So we did look at that.

MEMBER SKILLMAN: Thank you.

MR. SEBROSKY: the criteria that we applied for all these conditions were conservatism of design and operational limits and, if applicable, the warning time. Next slide, please. There's only one

bullet on drought. We dispositioned drought as the licensees would have sufficient warning time to take appropriate actions before they got to a point where there would be an issue with safety-related system structures and components.

The low water level due to a downstream dam failure, both this issue and the seiche were identified by the staff needing more of a look to make sure that there wasn't a need for additional regulatory action. There's a March 11, 2016 letter that's referenced that dispositions the sites that have seismically qualified dams. It goes through a process and essentially argues if it's non-seismically qualified, it's assumed to fail, as far as making any strategies. Seismically qualified dams are not assumed to fail, but what happens if they fail due to a sunny day dam failure? All sites screened out with the exception of Robinson. What you see in the paper is a discussion of the process that we used to look at downstream dam failures, in general, how that led to an additional look and risk assessments associated with sunny day failures of seismically qualified dams, and then the one plant that warranted additional analysis is provided in the paper, and that's Robinson.

MEMBER STETKAR: Joe, could you explain to me -- I had problems getting my hands around the difference between the risk-informed assessments that were done for that set of sites on downstream dams that you're characterizing close out Task 2, and other technical assessments that are going to be done for things like snow loading and high winds that you're characterizing as requiring a Task 3 vision. Why are they conceptually different to me?

MR. SEBROSKY: To be honest with you, a lot of it had to do with timing. The issue, when it comes to these, plants, we believe we had enough information that we could close issue out as part of Task 2. When it comes to Task 3, we outlined a process that we would use, what the issues are for snow loads, and also for hurricane and tornadoes. The logic that we would be applying as part of Task 3 envisions both potentially qualitative and quantitative analysis.

MEMBER STETKAR: But what I was trying to get at is -- let's take a situation where in Task 3, you want to address an issue of, let's say, hurricane missiles, and that you determine there's a subset of sites, because of their locations, that might be susceptible to that hazard -- they might be located

close to the Southeast of the U.S., close to a coast -- and that you might, as part of that process, do some sort of risk-informed assessment, in terms of the likelihood of missiles striking a particular part of the plant and determine that the likelihood is low enough so that it doesn't justify any further regulatory action. Conceptually, what's different between doing that and what you did for the downstream dam failures in the potential generic issue?

MR. SHAMS: I would say it wouldn't be different. It's just a matter of what would be the least, if you would, resource intensive -- the shortest way to the answer. We'll start with understanding margin built in these facilities. We'll go further to understand administrative controls that would actually eliminate that, and then we can get into risk studies. For tornado, we have risk studies already done. For hurricane, the industry has done some, and we're seeking to understand what they've done.

MEMBER STETKAR: I'm not probing how to do the analysis. I'm probing the notion of -- I think you're telling me that you've already done a Task 3 assessment for downstream dam failures, and you've checked off the box that it's done. You haven't done

the Task 3 assessment for, let's say, hurricane missiles.

MR. SHAMS: That's a true statement because we benefited from the fact that the downstream dam failure was a pretty generic issue that started over a year and a half ago, so that's quite a difference.

MEMBER RAY: Let me just note to the members that on this slide here, the conclusion, "Generic regulatory action to address downstream dam failures is not warranted," basically what Joe's been talking about. The question as to whether or not we want to look, as a Committee, into that conclusion further is due to be discussed at PNP tomorrow, separately from this presentation here. I'm not wanting to introduce that discussion into the presentation that's made here, but we were asked that question, and we will talk about what our interest is in pursuing that further tomorrow.

MR. SEBROSKY: One of the things that you see in the paper, that was discussed in the session earlier on, that's a shorthand conclusion, downstream dam failures are not warranted. There are non-trivial activities that are continuing as part of the NTTF 2.1 recommendation. What you see when it comes to

Robinson, as an example, and it was discussed this morning, Robinson has a non-trivial change in ground motion response factor. It's not a plant that's unique in that manner.

The seismic that's being done for that plant, is that going to also assess the downstream dam as part of the seismic PRA. Next slide. Low water conditions due to a seiche. This, again, is another pre-generic issue that was identified by the Region 3 regional administrator. The concern, when you look at the March 18th letter, if you pull that up, you would see that the regional administrator and her staff were particularly concerned about the plants along Lake Michigan because they were in a drought condition at the time. When they started looking at the FSARs for some of those plants, they noticed that flooding due to a seiche were assessed, but low levels weren't. The concern is that if you start with a low water level and you throw a seiche on top of that, as it oscillates back and forth in a Great Lake, you would get to such a low water level that you would lose net positive suction head to the safety-related ultimate heat sink pumps and either air bind the pump or damage the impeller.

That's the concern that the Region 3

regional administrator laid out in her letter suggesting that NRC staff needed to take a closer look at it, which is what we do in the paper. We took over the pre-generic issue. The white paper, we evaluated plants along the Great Lakes and the Chesapeake Bay. I don't mention the Gulf of Mexico.

We also looked at the Gulf of Mexico plants in the white paper that was discussed in front of the ACRS Subcommittee. We concluded that the two plants along the Gulf Coast did not rely on the Gulf for a safety-related heat sink. They had impoundment ponds. What the staff evaluation looked at -- when we go to the next slide -- just hold on a second -- there was an ACRS comment on we need to look more broadly than just the Great Lakes, Chesapeake Bay, and the Gulf of Mexico. The evaluation that we discussed with the subcommittee, what we looked at is whether or not a site had 24 hours of on-site water supply. If it had 24 hours of on-site water supply, where it didn't have to rely on the Great Lake or the Chesapeake Bay, we felt confident that after that amount of time, the ultimate heat sink should be available for it to get heating removal capabilities.

The mitigating strategies equipment, in that case, would allow the plant to ride out the

problems with the ultimate heat sink. There were some plants that didn't have a 24-hour water supply, so we looked at their ultimate heat sink closer and made a determination in some cases. That review is continuing, so there's been adjustments to the paper since the April 26 paper that we looked at plants and the intake structure.

If the intake structure goes out a quarter of a mile, and it's such that there's enough net positive suction head to ride out any combination of low water level, plus a seiche on top of that, that we would conclude that plant is okay. The preliminary conclusion for all the plants is additional regulatory action to address low water level conditions due to seiche is not warranted. If you go to the next slide --

MEMBER STETKAR: Joe, I just want to make sure, for clarity, I think in the April 26th version of the paper that we've had, anyway, you've clarified that the intent on this particular issue is that anything that's documented in the paper that eventually winds its way to the Commission will be used to close out that proposed generic issue, as compared to the downstream dam failure, where there's a separate documentation enclosure of that issue. Is

that correct? In the original version that we saw for the subcommittee meeting, it seemed to say that they were kind of continuing in parallel, but everything is now focused on this particular paper, is that right?

MR. SEBROSKY: The paperwork has not been completed, but that is the thought, that the generic issue review panel would close out their activity based on our work.

MEMBER STETKAR: Based on your work? So that will be -- whatever's in this paper that goes up to the Commission will be the entire documentation to close out that issue?

MR. SEBROSKY: That's correct. That's the proposal; whether or not the generic issue review panel agrees to that is a different matter. Slide 14, we did -- and you see some of these changes in the redline/strike out that you've been provided -- similar to the Robinson low water level conditions, when we talk about the 24-hour water supply or pressurized water reactor, in particular, we were concentrating on the steam generators because that is typically where you run out of water first. We're adding additional discussion on the primary side to demonstrate that we looked at the water supply for the primary side.

MEMBER STETKAR: Joe, did you think about loss of cooling water, for example, for ventilation systems, chilled water -- the ultimate heat sink for chilled water systems that provide ventilation for the rest of the plant, cooling for that type of stuff?

MR. SEBROSKY: There was a concern that was expressed -- and that's why you get to the use of low leakage reactor coolant pump seals -- that if you do not have the low leakage reactor coolant pump seals, the concern on the primary side is a loss of cooling capabilities to either the room, or the sealed cooling that normally would be provided by pumps that have power supplied to them by safety-related buses, that if you lose cooling to the pump seals or to the rooms that house the equipment, it's not just that you have a safety injection pump that's pumping water to cool the pump seals. You fundamentally assume if you lose that, you have an issue. You could also lose room cooling to that safety-injection pump. That could cause a problem, such that you lose the reactor coolant pump seal and the mitigating strategies would not be able to compensate for the leakage from a pump seal that fails.

What we looked at, to answer your question directly, is can you maintain containment, can you

maintain reactor, can you retain the fission product barrier for the fuel? We made a determination that you did not need those support systems for these scenarios. The spent fuel pool, we fundamentally made an assumption that they have enough water in the spent fuel pool to ride out 24 hours without make up.

MEMBER STETKAR: I guess I'll be interested to see what you did and what you didn't do. Because I specifically asked you questions that would affect ventilation, that might also affect instrumentation and control power supplies. You focused on reactor coolant pump seals, which is one thing that might be affected. There might be others. So that's why I wanted to make sure that whatever's documented in this paper will be the sum of the analyses that were done to close out this issue --

(Simultaneous speaking).

MR. SEBROSKY: As part of the mitigating strategies, there is an assessment -- if you lose -- Stew, you can correct me if I'm wrong. As part of the mitigating strategies compliance with the order and eventual compliance with the rule, a plant has to demonstrate that it can remove decay heat both from the spent fuel pool and from the reactor, and maintain containment, given the loss of the ultimate heat sink,

and also extended loss of AC power. That does look at whether or not instrumentation is affected. Did I say that correctly, Stew?

MR. BAILEY: You did. This is Stewart Bailey. I'm one of the branch chiefs in the JLD. What you're talking about here is part of the staff's overall evaluation of mitigating strategies. It does take a look at loss of heating and cooling around the plant, and looks at the functionality of all the equipment that's relied on for the mitigation strategies.

MEMBER STETKAR: So in this case, we're dismissing the hazard because we have assurance that flex is going to protect us?

MR. BAILEY: That's correct.

MEMBER STETKAR: Okay, thank you.

MR. SEBROSKY: So if you can go back to the slide, there was one other thing. The last bullet on this slide, I just wanted to touch on briefly. One of the ACRS member comments was we should look at the Atlantic and Pacific coastal plants. There are plants that are connected to the ocean and there's a bay between, Biscayne Bay, for example.

For Turkey Point, there's a bay between the plant and the ocean, and whether or not that bay

would be susceptible to a seiche. For every plant along the Atlantic and the Pacific, we're adding an evaluation to look at that condition. Preliminarily, the determination is they are not susceptible to an appreciable seiche or the safety-related ultimate heat sink is not tied to the bay.

The next slide, one of the other things that was looked at, we talked about low water level conditions. The other task that was looked at as part of Task 2 is extreme temperatures. We looked at both high and low temperatures. This slide talks about the evaluation for extreme high temperatures. The staff considered tech specs and, essentially, operability determinations that licensees are compelled to do if they see temperatures that are outside their design basis. We concluded that additional regulatory actions are not needed because of those controls. In addition, the last bullet talks about the mitigating strategies equipment as part of NEI 12-06, both the procurement and the operation is to consider high temperature conditions.

Next slide, please. For extreme low water level conditions, it is a very similar logic as extreme high level conditions -- extreme temperature conditions, the extreme low, the logic for that is

very similar to the extreme high temperature conditions. That is that plants that are experiencing outside beyond design basis temperatures are expected to take action.

There are additional references in the evaluation that talk about information notices, generic communications that we've issued in the past on problems that we've seen with plants due to icing, including frazil ice. Two of the information notices are referenced. That is background that there are existing regulatory processes that continue to look at these types of events and make determinations on whether additional regulatory action is needed. Again, the last bullet on here talks about the mitigating strategies equipment is expected to consider potential impacts on low temperature. The preliminary conclusion is that additional regulatory action for extreme temperatures is not warranted. Next slide.

MEMBER SKILLMAN: Joe, would you go back to 15, please? At the last bullet, you have the phrase, "Both procurement and operation," and then on 16, you have that same item at the fourth bullet. What do you mean when you write procurement on each of those slides, please?

MR. SEBROSKY: I'll look to Eric Bowman if I say anything incorrectly, but when you look at NEI 12-06, there is specific guidance that when you procure a pump, for example, that the temperature range for that pump that you procured can work in the environment that you're expected to see. That's the same thing for the operation. When you go to operate the equipment, it has the ability to operate in hot weather or cold weather conditions.

MEMBER SKILLMAN: I was thinking when I saw that that it meant procurement of fuel oil and other expendables that you need to operate the plant through what could be dismally extended low temperature conditions, how you bring on your tractor trailers to get your fuel oil. Because if you're running your diesel engines or your boilers, you need that oil. I thought that's what you meant, so that's not it. You're saying that's the design spec for the low temperature for the facility?

MR. SEBROSKY: I believe it also considers the operation. If you look at the -- there's specific discussions in there for the cold weather conditions that if you're also experiencing snow and you need to move a flex diesel generator, that you have the capability to get the diesel generator out of the

Phase 2 storage area to where it needs to go. I believe it also would encompass the diesel fuel oil that goes with that, that that'll work in those temperature conditions.

MEMBER SKILLMAN: Thank you, Joe. Thank you.

MR. SEBROSKY: The next slide is a discussion about Step 3 of the assessment. There were two issues that are evaluated in Step 3 of the process. That's snow loads and high winds from hurricanes and tornadoes. The staff identified these issues because in both cases, new guidance had been provided in these areas that was promulgated after the current operating fleet began operation. The preliminary assessment includes a discussion of the issues and the staff's preliminary process for evaluating the issue. The target, again, for completing the assessment is the end of December. For snow loads, the new guidance that we're evaluating the current operating fleet against is ISG 7.

It was issued in July of 2009 as a process for calculating 100-year snow loads, and then combining that 100-year snow load with an extreme snow load. The assessment that we're doing is looking at the current operating fleet against that guidance.

One of the things that we mention in the paper as part of this assessment, we will look at the design conservatism and warning time associated with this hazard as part of the evaluation to determine if additional regulatory actions are needed.

When it comes to wind and missile loads from hurricanes and tornadoes, it's a similar story. There's new guidance that was promulgated for tornadoes in 2007, and for hurricanes in 2011. Reg Guide 1.76, Rev. 1 is the updated tornado guidance. The wind speeds actually went down, or generally went down for the majority of the sites. However, when you look at the missile spectrums, which are different, there's three missiles in Reg. Guide 1.76, Rev. 1, and the previous guidance had several different missiles. Even though the wind speed went down for the majority of the missiles, there were some cases where the automobile missile speed went up. Next slide. Reg Guide 1.221 is the hurricane guidance. In general, the hurricane wind speeds are bounded by tornado wind speeds.

We showed a graph at the subcommittee meeting. That's the case for the majority of the operating plants, with the exception of the plants in Florida. The hurricane wind speed for the plants in

Florida is higher than the tornado warning guidance. The hurricane missile speeds, even though the hurricane wind speeds are generally less for a given site, the missile speeds, when you look at the missiles, went up.

That is because the hurricane generated missile has a longer time in the wind field and has a chance to come closer to the hurricane wind speed than it would in a tornado wind field. Our assessment that we're doing is broken into two generation of plants. There were different criteria for -- we call it the pre-general design criteria plants, essentially plants that were licensed prior to 1970, prior to the 1975 version of the standard review plan. Because they have different capabilities, we're separating those two generation of plants out as part of our assessment. Looking forward, as part of Task 3, the IPEEEs that were done in the '80s and '90s, we are going to take advantage of those to see if we can gain any insights, and we're also looking to take advantage of current activities with high wind studies that are ongoing.

When it comes to hurricanes, which we believe have much longer lead times, as far as warning goes, than tornadoes, we also want to gain a better

understanding of what licensees do to minimize the potential for missile generation prior to hurricane winds being received on site. Again, the target is to provide a completed assessment by the end of the year.

MEMBER STETKAR: Joe, something I actually just thought about. Earlier, you said you're taking credit for flex mitigation as a way of disposing of some of these external hazards that you have on your list. I haven't heard much about flex shelter being protected against high winds and high-wind missiles. Are you also looking at that, or are you just looking at -- because you mentioned IPEEE, as well. I didn't have any flex equipment back in the '90s. Will that be part of your assessment, also, for these? Because then you'll have to look at a broader scope than just looking at what somebody did in their IPEEE.

MR. SHAMS: I'll get that question. Part of the design criteria for mitigating strategies equipment in 12-06 is to look at high wind and look at tornado and hurricane as appropriate to these sites. Your observation that we have not brought that into the discussion yet, for instance in snow and hurricane, is true. We're doing an earnest job just to understand the risk and the hazard to the sites, and then as we close the issue, we would be including,

also, the fact that mitigating strategies are there to take care of the plant.

MEMBER STETKAR: Thanks, Mo. I just wanted to make sure that I had a picture of what you were going to be looking at. Thank you.

MR. SEBROSKY: The only thing that I would add is when you look at NEI 12-06 with specificity, it says if you're in a plant that's susceptible to snow, there's specific guidance on what the Phase 2 facility should be designed to. Similarly, when it comes to hurricanes and tornadoes, there's specific guidance for where the Phase 2 equipment is stored to protect it against those hazards. The last slide is -- we are, right now, in the process of making adjustments based on concurrence, comments we're receiving internally on the document, and also based on the ACRS feedback that we heard from the April 21st meeting. We believe we're still on target for providing the Commission a product by the end of May, and then the completed assessment will be due to the Commission by end of December. We believe that we will need to engage the ACRS again in the fall on the Task 3 assessments. That's all I have.

MEMBER STETKAR: Thank you. Any members, questions for the staff? If not, thanks a lot. You

covered a lot of stuff very efficiently. We're going to get the external phone lines open. While we're doing that, I'll ask if there's anybody in the room who has a comment that you'd like to make? Please come on up to the mic and do so. I heard the telltale noise in our speakers, so if there's anyone on the bridge line, first of all, just do me a favor and say hello or something like that, so that we know you're out there and can hear you.

MR. LEWIS: Hello, this is Marvin Lewis.

MEMBER STETKAR: Thank you, Marvin. Now, if there's anyone who would like to make a comment, please identify yourself and do so.

MR. LEWIS: I sure would like to make a comment, maybe it's more of a question, I'm not sure. I've been worried for a long, long time about something very simple. Namely, in a reactor, you have an accident, whatever it is, water, wind damage, who knows? Sure enough, the reactor's operating. It suffers some kind of a problem. Now, here's my question. It's had a problem. It's operating at criticality. How long does that criticality continue after it's damaged, or does it stop immediately? What is your calculation? I can't find it in whatever. Thank you.

MEMBER STETKAR: Thank you. Are there any other members of the public who'd like to make a comment? If so, just speak up. Identify yourself. Hearing none, we'll reclose the bridge line. Again, thanks to the staff, and I'll turn the meeting back to you, Mr. Chairman, this time early.

CHAIRMAN BLEY: Indeed, you are. Thank you very much --

(Simultaneous speaking).

MEMBER STETKAR: On average, I'm ahead of the game by 17 minutes. That's all I --

CHAIRMAN BLEY: That's true.

MEMBER STETKAR: You owe me.

CHAIRMAN BLEY: At this point, we will recess for lunch and return at 1:00 to consider the NuScale topic report on risk significance determination. We are recessed until 1:00.

(Whereupon, the above-entitled meeting went off the record at 11:27 a.m. and resumed at 1:02 p.m.)

CHAIRMAN BLEY: The meeting will come to order. We're going to proceed to the NuScale Topical Report, and I'll turn it over to Professor Corradini.

VICE CHAIRMAN CORRADINI: Thank you. So we're here today to talk about a licensing topical

report regarding risk significance determination, so little background for the committee.

We had a subcommittee meeting on March the 1st, where NuScale who now is online, they're not physically here present, but NuScale presented their LTR on the risk significance, which implies that what they have is an approach which is different than the normal approach to determine candidate lists of risk-significant SSCs for the D-RAP program.

MEMBER RAY: Sorry, what? LTR please? You said they presented their LTR. That's an acronym for --

VICE CHAIRMAN CORRADINI: Their license topical report.

MEMBER RAY: License topical report, thank you.

VICE CHAIRMAN CORRADINI: No problem.

MEMBER STETKAR: And as long you're speaking in acronyms, Mr. Thermal Hydraulics, D-RAP?

VICE CHAIRMAN CORRADINI: Design Regulatory Assurance --

MEMBER SKILLMAN: No, Reliability.

VICE CHAIRMAN CORRADINI: -- Reliability Assurance Program.

MEMBER SKILLMAN: Design Reliability.

VICE CHAIRMAN CORRADINI: Thank you, everybody. So the topical report is a proposal by NuScale on a different approach to determine their risk significance SSE candidate list, okay, which I'm sure the NRO folks will explain in better, for tonight.

But I just wanted to at least to get across that we had our subcommittee meeting on March the 1st. There were some changes made to the SE so we delayed our consideration in full committee, and the SE you now have in front of you is the final SE from the staff on this license topical report.

So let me turn it over to Omid Tabatabai, and you will lead us through this.

MR. TABATABAI: Thank you so much, Dr. Corradini. I thank you. Thank you. Thank you. I think you summarized everything very nicely. Thank you very much for making my job easier.

MEMBER POWERS: You realize that when you say things like that and I have to sit next to him, he gets the big head.

MR. TABATABAI: Well, we can switch --

(Laughter)

MR. TABATABAI: Well, as mentioned we received some recommendations from the subcommittee to

qualify some paragraphs in the draft SER we completed, and we sent you a final SER. Beyond that I won't talk about it and I'll turn the microphone to our PRA analyst, senior PRA analyst Mr. Caruso.

MR. CARUSO: Thank you, Omid. So, if we can have the second slide, so I guess what I thought I would do since I think maybe there's some members here that probably weren't here for subcommittee --

CHAIRMAN BLEY: We had about four of us were physically here, so I think if you can give us a little bit of a --

MR. CARUSO: So I thought I would give you a brief summary, for the new members, of the topical, and NuScale did this at the subcommittee meeting but they're not, you know, the folks are not here. They're on the phone.

But I'm going to try and make this quick. So if you go to Slide 3, as Dr. Corradini said, NuScale has proposed a, this is a brilliant topical report proposing some new criteria or revised criteria for assessing the significance.

And the criteria are different from the ones that are documented in Reg Guide 1.200 that have been used by the operating reactors for maintenance rules stuff and also been used by the large light-

water reactors.

And they're proposing to use a more absolute measure of risk significance than a, you know, a factor beyond some baseline in sensing that I look at how much increase I have in a core damage frequency or large release frequency and set a threshold on that parameter as opposed to a relative parameter of like two times this or three times that. And they've also done the same thing for the Fussell-Vesely importance measure.

But here they have stuck with an actual importance measure, but scaled it to match their projected core damage frequency and large release frequency which are expected to be quite a bit lower than the operating reactors.

And so in the next slide, as I said, the current criteria were developed for operating reactors back some time ago and sort of implicitly based on the generic core damage frequencies that they have of around 10 to the minus 5 to 10 to the minus 6.

So NuScale has been showing in their PRA analysis that their core damage frequency is expected to be below 10 to the minus 7 and appears to be getting lower every time I talk to somebody.

And so it turns out that the original

importance measures in criteria essentially have buried in them the, essentially based on the typical core damage frequencies for the older reactors. And what it means is, is that for the, if we use those criteria with very, very low core damage frequency, you end up identifying, you end up having a much different absolute increase in risk associated with the assumption of a 5th component.

And the way we do these things is they say, you know, they look at a component and they say, well, what if I completely fail it? That's the conditional part. Conditional on assuming it's completely failed, what happens to the core damage frequency? How high does it go?

And so NuScale said I'm going to use a criteria that's based on that value. And if you look at what that value would be for the operating reactors based on the numbers they use it's about in the 10 to the minus 5 per year range.

So to get a value that's, you know, near that for NuScale that they would have to use, you know, a much, much different value of importance measure than what the operating reactors are using.

So they're saying, you know, the important thing is, is the absolute increase in core damage

frequency when I assume the component has failed. So that's the criteria I want to use. I don't want to use the relative number.

And these are because if they were to just do it the old way with the old comports measures they would in fact be identifying, probably identifying things that weren't truly risk significant.

MEMBER STETKAR: Mark, if I take out a calculator and can divide the difference between 1E to the minus 7 and 3E to the minus 6, to me is a factor of 30.

So I understand people want to call a number a number and people want to call a different number a different number, but I don't understand the fundamental difference between saying I'd like to achieve a factor of 30 in increase in my core damage frequency versus a 3.000E to the minus 6.

And philosophically I don't understand why there's a difference between those two.

MR. CARUSO: I don't understand your question.

MEMBER STETKAR: Yes, I was afraid of that.

VICE CHAIRMAN CORRADINI: Feel free to expound.

MEMBER STETKAR: I will. If my core damage frequency is 1.00E to the minus 4, and I have a risk achievement worth of 2, which is interpreted as a relative measure, it says that I can increase my core damage frequency to 2.000E to the minus 4 --

MR. CARUSO: Yes, I understand that.

MEMBER STETKAR: -- which is an absolute number. If I have a core damage frequency of 1E to the minus 7 and I have a risk achievement worth of 30, I can increase my core damage frequency to 3.000E to the minus 6. That's math.

MR. CARUSO: Yes.

MEMBER STETKAR: Okay.

MR. CARUSO: I understand that.

MEMBER STETKAR: It's not a fundamentally different concept, so I don't understand why we're arguing about is this an absolute measure that we're approving or is it a relative increase?

MR. CARUSO: Right. We both understand what's going on here and if you don't want to call it absolute that's fine with me.

MEMBER STETKAR: Okay.

MR. CARUSO: You know, the reason I think, you know, it was never an absolute, right? There is something beyond it, which is really, the 10 to the

minus 5, the 3 times 10 to the minus 6, they're really sort of anchored to the safety goals. That's the absolute here if you want to get to absolute.

And those aren't even absolute, you know, you could be fatal when you have different safety goals. So, no problem.

MEMBER STETKAR: Okay.

MR. CARUSO: So let's see, where were we here? So anyway, so yes, what are these numbers based on, the 10 to the minus 5 or 3 times 10 minus 6, why did you choose those as your threshold for risk significance?

And basically what we have, the staff has developed Reg Guide 1.174 and it is sort of the official guideline on where we think changes in risk become significant in terms of frequencies, core damage frequencies and large release frequencies.

So these numbers, 10 to the minus 5, 3 times 10 to the minus 6 are in line with that and so that's the basis that NuScale provided in their topical report and it's the basis that we were fine with the thresholds that they proposed.

They also discussed a component, a system level importance measure over a component level importance measure, and they developed it using the

same approach and basis as the current industry practice in NEI 00-04 which is an industry document that I'll talk about a little bit more later on assessing risk significance of sister structures and components using PRA and other deterministic factors that is being utilized for the application of 10 CFR 50.69 which is about ranking and categorizing SSCs according to risk and safety.

So if we go to Slide 6, so this is a summary of what's the findings that we have in the safety evaluation report. So this idea of using, you know, a threshold that's a core damage frequency, a large release frequency, a threshold on that, a conditional threshold there as opposed to using an importance measure, it's fine with us because the two are related. There's an equation.

So, you know, if you wanted to put a component in your PRA and see whether or not the core damage frequency goes above a certain value that that's fine with us, you know, as long as we're happy with the threshold you're using. If you want to develop a threshold in core damage frequency and then derive an importance measure to stick in your code that's okay too.

VICE CHAIRMAN CORRADINI: So can I ask

you, I'm not sure if you're at the third bullet or not, but I have a question about the third bullet which intrigues me. So maybe I'm misunderstanding the third bullet.

The third bullet leaves me to gather, or when I read the SE I got a different impression than what I'm seeing in the third bullet. So could you explain the third bullet to me about importance measures may be scaled?

MR. CARUSO: Yes. So in this scale I'll say, you know, I want to use just the criteria, the 3 times 10 to the minus 6, and which I believe, I think they've told me this, you know, that's what they're going to do in their code.

I mean, they're going to calculate the change and they're not going to use an importance measure. Now they could do an importance measure, and I think, you know, when they do these calculations it seems to me you put 1.0 to the fairer probability, you actually calculate core damage frequency, that's what these PRA models do, and then they divide it by, you know, the original core damage frequency and look at the relative result.

And they say, oh, now I can compare that with my RAW value of 2.0. So it's one and the same

thing. So what they're saying is, if I were to use a RAW I should need to derive one that gives me the same amount of risk increase, the same risk increase as I would for operating reactors because I want to be the same as them in terms of actual risk.

VICE CHAIRMAN CORRADINI: So, okay.

MR. CARUSO: So the scaling part is if you're going to use, you know, the numbers that are in Reg Guide 1.200 are relative numbers, 2.0.005. So if they had come in and said, well, we don't want to use those, we want to use different ones, that would have been fine and they would have said, okay, we're going to scale to the new ones so that what I hold constant is the threshold on risk increase I would get so that operating reactors would, you know, threshold would be the same or almost the same.

Actually this scale is proposing something conservative. Operating reactor is saying, my threshold in core damage frequency is 2 times 10 to the minus 5 and so if I'm going to use RAWs and Fussel-Vesselys to do the implementation, I need values of 2 and 0.005.

If NuScale is going to do it with a core damage frequency of 10 to the minus 8th, then they need to use different RAWs and Fussell-Veselys to get

to the same place.

VICE CHAIRMAN CORRADINI: Okay.

MR. CARUSO: That's where the scaling part comes in. But they're saying for RAW, I don't want to use a RAW. And we're saying, you know, that's fine, if you didn't want to use one, you know, you can derive one, you know, with your threshold.

VICE CHAIRMAN CORRADINI: So let me try it with numbers just to help me and so you tell me where I'm misinterpreting, because when I read your third bullet, here, and I read the SE, they seem different. So let me try an example and you tell me where I'm misunderstanding.

So to put it in relative terms, absolute relative, you're right, it's kind of interchangeable. Right now NuScale is saying, if my total CDF were 10 to the minus 7th, then on a component basis I would look at a RAW of 30 before I start getting worried, before it would rise to the level of risk significance.

MR. CARUSO: Right.

VICE CHAIRMAN CORRADINI: Okay. Now the way I read the third bullet here, and you correct me if I'm wrong, is the staff is all right with some sort of scaling that would scale at 30 at 10 to the minus

7th and scale back to 2 at 10 to the minus 5th. Am I misinterpreting?

MR. CARUSO: No. Okay. I don't --

VICE CHAIRMAN CORRADINI: Okay.

MR. CARUSO: Staff, as far as the staff is concerned they're fine with that. And if NuScale were to come in for the application for D-RAP and say, okay, here's our D-RAP stuff and we're referencing our topical report, and guess what, you know, we found out for some odd reason that we were really confused about our design.

And or, you know, for some reason they put it on a fault line or whatever that that core damage frequency is back down to the operating reactors, and we would say you probably need to scale back to something and you need to use 3 times 10 to the minus 6 not 2 times 10 to the minus 5 to do the scaling because that's what in your report. That's your method. Scale up, scale down.

So now what NuScale said it last time at the last meeting was that I wasn't taking their approach. And they were saying I've already thought about going to, already thought about scaling to core damage frequencies that were lower because I know that's where I'm going and I never really thought

about going the other way, and so if I had to go back I would just use what operating reactors do. That's what they said, but that's why you felt it was ad hoc.

Go ahead, I'm sorry.

MEMBER STETKAR: Yes, I was going to say so let's take, as we've discussed in the subcommittee, the condition where they've reevaluated, they have the final design, they did their complete PRA, and their core damage frequency comes out to be 3 times 10 to the minus 6.

And that to me says every piece of equipment in their plant is risk significance because if I fail anything, guaranteed, it will put me above 3 times 10 to the minus 6, guaranteed. So every piece of equipment in their plant would be in their D-RAP box according to this.

And you're saying no, if they're going to apply a sliding scale that wouldn't be the case, and they certainly wouldn't want that to be the case. So so that's where we get into this notion of arbitrariness of what do people do if, in NuScale's case right now, their core damage frequency is 3 times 10 to the minus 6?

How do they populate their D-RAP box, because if that's the case every piece of equipment in

their plant is in the D-RAP box. If you guarantee --

VICE CHAIRMAN CORRADINI: Is that a question for Mark or for NuScale online?

MEMBER STETKAR: It is a question for Mark because Mark is saying that this construct is in that third bullet there, I thought he was saying, is consistent with some sort of sliding scale. And that sliding scale would apply at 3 times 10 to the minus 6, but not according to the second bullet.

MR. CARUSO: Well, isn't that the same for an operating reactor who has a core damage frequency of 2 times 10 to the minus 5?

MEMBER STETKAR: Well, in my mind it is, but I'm too simple minded to understand these things, so apparently the operating reactors don't feel that they need to get that sophisticated.

MR. CARUSO: I'm not sure what you mean. I mean, it's the same thing. All their stuff would be in the box. And what will we say? We would say, okay, go back and put your hat on and really figure out what's really true here?

And maybe we would say, okay, maybe we need to modify this method somehow in terms of these importance measures and how they relate to core damage. Yes, I understand what you're saying.

VICE CHAIRMAN CORRADINI: Are you --

(Simultaneous speaking.)

MEMBER STETKAR: No, I'm not. But I'm honestly searching for how what we're hearing here and what's written in the SER and what's written in the topical report all give me confidence that I know what NuScale would do if their core damage frequency, calculated core damage frequency were 3 times 10 to the minus 6.

VICE CHAIRMAN CORRADINI: So should I ask NuScale to --

MEMBER STETKAR: We can do that. I mean, I haven't heard the staff say what they would do.

MR. CARUSO: I can tell you what we'll do.

MEMBER STETKAR: What would you do?

MR. CARUSO: We'll review their proposed D-RAP program when it comes in, which includes a whole lot more than these importance measures in figuring it out, and we would hope to come to in that process something that makes sense.

MEMBER STETKAR: But for regulatory stability, if I'm an applicant and I don't know what you're going to do when you review my D-RAP program, you're asking me to come in with a box that's populated according to some algorithm that I'm going

to use and then you're going to say, well, you might change that algorithm.

MR. CARUSO: Well, we have guidance in the D-RAP SRP that says you can use the whole categorization approach using risk and all these, and other factors. It's all laid out in Reg Guide 1.201 which references NEI 00-04, which it's 30 pages long.

It's how you do it for seismic, how you do it for fire, how you do it for internal events, when you use sensitivity studies, how you apply deterministic information, what you do when it's a seismic margins analysis, not a seismic PRA.

That's our guidance and that's what we're going to use when they come in for their D-RAP. You know, we looked at this in a very narrow way when it came in as this business about our SRP 19.0-7. If you want to do something different than what's in Reg Guide 1.200 you've got to come and talk to us and see if we see it's okay.

And so if we look at this as they were asking saying, hey, we're going to do this thing where, you know, we're not going to use 2.0 and 005, we're going to do something else, so we need to come to you and see if that's okay. And we looked at it in terms of just that.

And that's why the SER says that the real application of determining risk significance for D-RAP and the whole D-RAP analysis is going to get looked at, you know, separately.

And we didn't dig into all that stuff here. We just looked at these things and said 3 times 10 to the minus 6 is fine, and then the other things they said. So --

VICE CHAIRMAN CORRADINI: Can I just correct, make sure --

MR. CARUSO: Yes.

VICE CHAIRMAN CORRADINI: -- because you guys are speaking in much more specifics than I'm capable of on this area. If I just complete the one sentence you said that 3.10 minus 6 is fine given that their estimate of their overall CDF is as low as ten to the minus 7. Isn't that the proviso?

MR. CARUSO: No. The 3 times 10 to the minus 6 is a conservative number with respect to what operating reactors use. In effect they use 2 times 10 to the minus 5. So they're saying I can have more risk increase before I say it's risk significant.

VICE CHAIRMAN CORRADINI: They meaning NuScale?

MR. CARUSO: No, operating reactors. In

their analysis they would say my threshold is higher than NuScale's, so NuScale's threshold is lower. And the threshold is independent of the baseline CDF.

VICE CHAIRMAN CORRADINI: Oh, okay. I think I understand what you're saying.

MR. CARUSO: John's saying that's true and when the core damage frequency gets to be equal to the threshold the whole concept kind of has a problem in terms of, you know, because it's -- you know, I mean, they're getting a lot of components.

I mean, you know, the threshold if you add everything up for all the hazards and everything you stick, you know, you go into the fire PRA and you fail the component and you get some little delta risk increase. You go to the internal events PRA and if you have a component you get another little delta.

Keep adding those deltas up, and when the total gets to be beyond 3 times 10 to the minus 6 then it goes in the box. So I'm not sure that everything that would go in the box for NuScale or for operating reactors, but --

VICE CHAIRMAN CORRADINI: Okay. And you're interpreting this, I see, now, I think I see how you're interpreting this, which is not how I interpreted the SE. I thought in a totally different

light. So are you clear now?

MR. CARUSO: No.

VICE CHAIRMAN CORRADINI: Okay. You'd call 3 times 10 to the minus 6 conservative because you're looking upon it as a delta on top of regardless of what their CDF risk is. So if they're 10 -- so let me say it again just for my own edification.

If it's not 10 to the minus 7th but it turns out to be 10 to the minus 6, you still would hold them to the 3 times 10 to the minus 6. If it's 2 times 10 to the minus 6, you still hold them to 3 times 10 to the minus 6. If it's 10 to the minus 5, you'd still hold them to 3 times 10 to the minus 6.

MR. CARUSO: Okay, I got it. I mean, I think the 2 and 005 were developed, you know, to try to give you something sensible.

VICE CHAIRMAN CORRADINI: Understood.

MR. CARUSO: And so we would not do something nonsensical from NuScale if they for some, I don't know, odd reason that they would end up there. So I think, you know --

VICE CHAIRMAN CORRADINI: I think you don't have to explain it. I get it now.

MR. CARUSO: I mean, who says, you know, scale, you know, within a range scalability is there.

I mean, there's no question about that. Now it may be that it gets into trouble somewhere and so you want to pick judiciously, you know, I haven't thought about what happens if they get all the way down there.

VICE CHAIRMAN CORRADINI: So let me try an example on you, because I think I know the answer but let me try an example. When I read the third bullet and I saw scaled I interpreted it totally differently. I interpreted it as that if my CDF was 10 to the minus 7th and the RAW was 30, if it turned out to be 10 to the minus 6 the RAW might be 20. And if it was 10 to the minus 5th the RAW would be 2.

In other words the --

MR. CARUSO: Yes.

VICE CHAIRMAN CORRADINI: -- RAW value would scale with --

MR. CARUSO: Right.

VICE CHAIRMAN CORRADINI: That isn't how you've explained it to me though. You've said that their baseline is so conservative that regardless of the CDF you would apply that baseline to it.

MR. CARUSO: We're talking about two different things. I keep talking about the absolute core damage frequency threshold --

VICE CHAIRMAN CORRADINI: Yes.

MR. CARUSO: -- and you keep talking about the relative RAW.

VICE CHAIRMAN CORRADINI: So in some sense the calculation you could argue with or you could explain it either on an absolute sense or on a relative sense.

MR. CARUSO: Yes, yes, yes.

VICE CHAIRMAN CORRADINI: Okay.

MR. CARUSO: So that didn't come through.

VICE CHAIRMAN CORRADINI: No, I think I get it. I think I get it. I used my example of 10 to the minus 7th, 10 to the minus 6th, 10 to the minus 5th, at 3 times 10 to the minus 6th you hold them to that regardless of whatever the value is. That's what I'm struggling with.

MR. CARUSO: Yes.

MEMBER STETKAR: 10 to the minus -- if their core damage frequency were 1 times 10 to the minus 5th, every piece of equipment in their plant, absolutely, would be in their D-RAP program because a plant would have to work better than perfectly to not be in their D-RAP program.

If that component was guaranteed to fail, their core damage frequency would become higher than 10 to the minus 5th by definition.

MR. CARUSO: Well, yes, I mean --

MEMBER STETKAR: Right?

MR. CARUSO: -- I think, you know, I think what we've said is that scaling in both directions is okay, but, and I think we would agree with NuScale that maybe this is why they said, if I get down to 3 times 10 to the minus 6th or down near operating reactors I would use the same thing operating reactors do.

But I think if you got to the point where whatever you're doing was not making any sense, they would want to do something different and we would want to do something different. You know, I'm not just going to say here, you know, I don't really care if it doesn't make any sense. They're going to use 3 times 10 to the minus 6, by golly. No, that's not the way we operate.

MEMBER STETKAR: Well, let me --

MR. CARUSO: And I don't think we said that in the SER. I think we said scaling is okay. So, and we -- go ahead.

VICE CHAIRMAN CORRADINI: No, I'm fine. I just wanted to make sure, now I'd like to get NuScale into the conversation so we're not misunderstanding.

So the folks at NuScale, can you unmute and enter the conversation here? Am I misinterpreting your topical report?

MR. GALYEAN: Well, this is Bill Galyean, supervisor here at NuScale, and --

VICE CHAIRMAN CORRADINI: Hello, Bill.

MR. GALYEAN: Hello. And I think the way Mark characterized it at the end there is we'll use whichever process makes the most sense. And, you know, the point that, you know, John was making that we would do stuff that doesn't make sense is a bit ridiculous, really.

And so if we get to the point where our core damage frequency is approaching that of operating reactors, well, then why not just use the same process that operating reactors use? As Mark said, you know, we'll only use this process if it makes sense, and we would reference it in our DCA.

VICE CHAIRMAN CORRADINI: Okay. Okay.

MR. GALYEAN: And so if we choose not to use this process then we'll say what process we are using that's already been approved by the NRC.

VICE CHAIRMAN CORRADINI: Okay.

MR. GALYEAN: So this whole discussion about oh, is this a relative, is there an absolute,

does it scale, does it not scale, it really overly complicates what we're talking about.

We were talking about something very simple and straightforward, absolute threshold. Our core damage frequency is significantly below that. You know, talking about these hypothetical situations, you know, is really off-topic in terms of the licensing topical report.

MEMBER STETKAR: And Bill, and for the record, I understand what NuScale is proposing. My personal concern is that the NuScale proposal is being reviewed by the staff in isolation for NuScale and NuScale only, and that then if another applicant comes in with their design and says that their core damage frequency is 3 times 10 to the minus 7 and they want to propose a value of 2.5 times 10 to the minus 6, the staff will somehow review that as an independent application and conclude that that's also reasonable because 2.5 times 10 to the minus 6 is still -- I hate the word -- conservative compared to what operating reactors are using.

And if the third design comes in and their core damage frequency is 1 times 10 to the minus 6 and they propose a 1 times 10 to the minus 5, well, that's still conservative compared to 2 times 10 to the minus

5, but that's only like a factor of 10.

And my bigger concern is this notion that the staff is not reviewing these consistently across all of the designs, and that we have a consistent notion of how we determine this significance.

And maybe it's time to do that because as new designs come in and people start proposing these very small core damage frequencies and trying to justify why their design reliability assurance box ought to be empty we have common understanding about why we feel comfortable with that.

That's my primary reason for taking issue with all of these things, not with the particular numbers or absolute relative anything.

VICE CHAIRMAN CORRADINI: Do the folks at NuScale like to have a comment? Otherwise I'm going to turn back to Mark. The folks at NuScale, if they have a comment please do so. Otherwise I'm going to turn back to the staff.

MR. GALYEAN: Okay. Yes, I mean, I agree with John's sentiment. You know, if this issue had been addressed generically previously, you know, the need for the NuScale LTR would not exist right now, and so it would have saved us a lot of time and effort.

VICE CHAIRMAN CORRADINI: Okay, that's on the record. All right, let me turn back to the staff. Bill, go to mute. I don't mean to be running the show but I'm running the show, so let's go back to staff.

MR. CARUSO: Well, yes. I mean, you know, I think we agree with the sentiment too. I mean, and we've talked about, I think you've brought this up at the subcommittee meeting.

And so I can't, as the reviewer of this topical report I'm not in the position to say we're going to do that. I think it's a good thing. I think everybody in this room would agree it would probably be a good thing.

MEMBER STETKAR: We brought it up in previous letters, oh by the way.

MR. CARUSO: We brought it up in previous letters too.

VICE CHAIRMAN CORRADINI: Keep on going, go ahead. I'm sorry for taking you off track. Make sure I understood that whole --

MR. CARUSO: Oh, okay. So with respect to the Fussell-Vesely importance measure, NuScale has proposed a, I hate to use this term, but scaled value to again to assure that they're looking at an equivalent amount of risk change as operating reactors

are when they use the importance measure.

And they found that for their very low core damage frequency or assumed core damage frequency they would have gotten a value of 0.5 that would be on equivalent footing with operating reactors instead. That probably doesn't make any sense.

And so they proposed a value of 0.2. 0.2 seems reasonable. Personally, I probably would have picked 0.1 myself, but I don't have any basis to nix 0.2, and I know that like I said before, in the NEI 00-04 there's guidance in there about doing sensitivities on all these numbers.

So when the D-RAP comes in for review we'll have expected that they had done a sensitivity on this value too and found it, you know, it was not a optimal choice, but they would account for that in their selection of SSCs that should be in the program.

MEMBER STETKAR: Mark, since you brought up most of this and we can get your slides here, one of the things we talked about in the subcommittee meeting is in the topical report they propose applying the Fussell-Vessely importance on a hazard-by-hazard and operating mode-by-operating mode basis.

So, for example, I think that means internal events at power, let's say internal fires,

internal flooding, you have seismic events, high winds and so forth, and then that same complement for low power shutdown, and also not only for core damage frequency, for large release frequency.

In one perspective that sounds prudent, if you will -- I'm trying to stay away from the word that I don't like -- because it says, well, if something is important to any one of these various hazards or operating modes I will put it in my box.

On the other hand, you can develop situations depending on the relative contribution from each hazard or operating mode to your total core damage frequency and the relative importance of specific components to each of those piece parts, where indeed you might have something in your box because it's important to one particular contributor that's actually less important to overall core damage frequency than something that is not in your box at all.

And people have tried constructs in the past to address that anomaly by applying a two-tiered approach that says, well, if it's greater than, let me just throw out numbers. If it's greater than in this example 20 percent, 0.2, on a hazard-by-hazard, operating mode-by-operating mode basis, that's one

criterion, and I have a different criterion, and again just an arbitrary number, 0.1 for overall core damage frequency such that I catch those anomalous conditions.

I don't know whether the staff has thought about that at all. It was one of the things that I thought about, you know, as I looked at thinking about applying this on a part-by-part basis.

MR. CARUSO: Yes. Well, the last agenda item we had was to talk about the issues that were raised at the subcommittee meeting.

MEMBER STETKAR: Okay.

MR. CARUSO: I skipped to Slide 8, and you go to the bottom of Slide 8, I put that together with the other issues that you had raised about, you know, how do you deal with a component that's got a bunch of basic events.

And I admit, I probably should have done a little bit more research and had this in the original SER. But we, like I said, have gotten so we have to do the D-RAP to actually do the analysis is this NEI 00-04 Reg Guide, and if you go in there it goes to great pains to talk about the issue of masking in a lot of different ways.

How what you do for one hazard could mask

something from the other one, and why it's important to do that on hazard specific basis if in fact you're looking for, you know, you're looking for something that's driving fire risk.

Not so much, you know, as a numerical risk significance of some number, but it may be significant because it's dropping the fire risk, and it may turn out that, well, that value doesn't meet your other criteria but from a design perspective it might tell you something that you want to do to fiddle with your design.

So there are reasons, you know, and it talks about doing an integrated analysis too. So there's plenty of guidance in there, I think, to conquer, you know the issue of how you deal with hazards. They have approaches in there for each of the hazards. They have specific techniques to address each of the hazards, and an integrated one at the end.

And I have to tell you, I mean, I had not, I was not involved in developing this document. I can't explain it to you right here and now, but I have gone through it.

And I feel comfortable that when it comes time to look at their D-RAP analysis, and we, they're on the hook to, I mean that's an acceptable approach

and we will use that as our guide as to what they come in with, you know.

It also talks about how you deal with, you know, basic events and components. It's got guidelines in there for that, which for using, for risk achievement, you know, you take the worst one. You know, if I've got five different failure modes and I pluck the one in for all them, all the basic events, and I find the one that gives me the worst answer and that's the answer I use.

So, I guess, overall, I'm saying, you know, we, like I said we do not view the review of this to be the complete, you know, implementation of a SSC categorization for D-RAP.

And I believe that we have guidance in place that staff has endorsed and that's what we say in our SRP that we find this an acceptable approach and so we'll follow that. And, you know, if there's -- that's all I can say about that.

MEMBER STETKAR: Okay, thanks. And again I apologize. I didn't realize that last --

MR. CARUSO: Well, I --

MEMBER STETKAR: -- was going to address it --

MR. CARUSO: -- didn't think I --

MEMBER STETKAR: -- publicly.

MR. CARUSO: -- on the first try. Yes, I think, yes, I admit to like all the issues that we're talking about I sort of save them for the last slide for those issues.

MEMBER STETKAR: I'm sorry.

MEMBER BROWN: Can I make an observation? I was at the meeting, and I don't know anything at all about Fussell-Veseleys and F- RAWs and all that kind of stuff, although I did understand somewhat the higher level basis, I think, for wanting to do this.

They want to reduce the number of things that they have to pay a lot of attention to, and that will be a better approach because they'll be able to focus more resources on the things that have more importance to creating safety for the plant.

What I got out of reading the topical report and your SER, I didn't see any connection between his numbers that tells me I don't have to do -- it reduces it by about 25 percent or whatever it was according to the report.

I didn't see physical basis does it makes sense relative to how this is applied in the SMRs and now we're not going to look at some things that we would have looked at in a big plant, and is there a

physical basis for why we don't have to in this, in an SMR because the numbers showed us we don't have to. That -- just numbers. At least I got the flavor that it was just numbers making the, you know, making the case --

MR. CARUSO: Yes.

MEMBER BROWN: -- for reducing the number of parts. So if that system is some components that in the bigger plants would say, oh, we've got to look at that and I've got a similar component in a small reactor but, oh, I don't have to look at that because is there a physical basis for why it makes sense that these numbers came out the way they are.

I didn't think about, I mean, I just never formulated that until I've been listening to this interchange here today. So that's --

MR. CARUSO: Well, this topical is really about a piece of the numbers part of the assessment.

MEMBER BROWN: So we can look at it physically --

MR. CARUSO: This topical --

MEMBER BROWN: -- system wise.

MR. CARUSO: It does. But this topical was not talking about, his topical report on a whole complete methodology for doing the analysis of what

should be the D-RAP program.

And the guidance the staff has out there go to well beyond the PRA numbers. Like, we're not risk based for risk informed, and if you look at the guidance for how you, like I was just saying, how you do that to decide what you're going to really focus on it's not just numbers.

All this topical was about was the number, the criteria that they use for the numbers part. They wanted a different approach there and they wanted our blessing on it, and that's all this is about. It's not about --

VICE CHAIRMAN CORRADINI: It's not the whole process. It's a piece of the process.

MR. CARUSO: It's a piece.

MEMBER BROWN: Okay, I just didn't understand. I just saw that the, what is, the F-V went from 0.5 to 0.2, and I just, somewhere along the line I didn't see anything in this overall process that it comes to some conclusions that things don't need to be looked at, and now does it make sense when I finally get to the point where I need to start looking at stuff.

This seemed to be more, what's the right word, ephemeral, abstract, and not connected to the

hardware and I'm kind of a hardware person. So that was just my observation on looking at it and I don't have any problems with reducing looking at stuff that doesn't matter, but how do you know it doesn't, how do you confirm that it really doesn't matter in these plants as opposed to the bigger plants? And I don't have any connection to that right now --

MR. CARUSO: Well, I think --

MEMBER BROWN: -- or where in the process that gets evaluated qualitatively, I guess.

MR. CARUSO: When they make their submittal for design certification and their proposed D-RAP program will have, you know, a full-blown, a methodology and the list that comes out of it on how they got that list and how they factored in operating experience, how they factored in the fact that some of these components are so new and novel that they don't have any data, they're going to have to deal with that, you know.

And, you know, we're very attuned to the fact that NuScale is full of new and novel stuff, and there's, you know, it's not going to be, you know, when it comes to D-RAP review as well as a lot of other reviews, it's not going to be same-old same-old for them or for us.

But they are bound to think about these things, operating experience, you know, they have in terms of making decisions, you know, they use the PRA to get some sense of what the PRA says, then they have people from all different disciplines, INC, you know, reactor systems, that sit around and say, now what's your perspective on the importance of this piece of equipment?

And they go, well, you know, boron dilution's not a very risk significant issue here, I mean I haven't seen much, but looking here at this and this and this, you know, I'm not sure you couldn't get a big, fat, cold slug of water somehow, and for that reason I think we should watch, you know, we should take care of this.

That's probably not a very good example, but the point is is that there are other folks with the hardware perspectives that are officially involved in this process, they're called the expert panel, and that's part of our guidance as to how you do this. It's how everybody, you know, the industry has done it.

So I guess I'm trying to reassure you that that aspect is alive and well and will be treated well by us when we get to the review.

MEMBER BROWN: Is it possible for them to screen out the reactor trip systems? It would be such a low risk thing that we don't have to review it in the design process?

MR. CARUSO: I doubt it.

MEMBER BROWN: I offered that up as an extreme example.

MEMBER STETKAR: It is very likely that they'll screen out diesel generators.

MEMBER BROWN: That seems to be somewhat problematic.

VICE CHAIRMAN CORRADINI: Well, it's not an AP-1000.

MEMBER BROWN: I understand that.

VICE CHAIRMAN CORRADINI: It may be in the D-RAP but it's not safety grade.

MEMBER STETKAR: This might now even be in the D-RAP.

MEMBER BROWN: Are the diesel generators in the D-RAP in AP-1000?

MR. CARUSO: I'm not ready to agree to that.

MEMBER STETKAR: I think they are but I don't, I think --

MEMBER BROWN: Well, we're talking about

D-RAP.

MEMBER STETKAR: I think they are because AP-1000, they come in under RTNSS stuff which is required 072 hours.

MEMBER BROWN: We're talking about D-RAP here, so I'm saying if --

MEMBER STETKAR: Well, it's --

MEMBER BROWN: -- system between that and the D-RAP. It's from a D-RAP system, that's all.

MEMBER STETKAR: Everything that is in RTNSS by -- RTNSS, again, full disclosure, regulatory treatment of non-safety systems that apply specifically for the passive reactor designs as opposed to active reactor designs, but the definition of everything that is in the RTNSS list is in the D-RAP program.

And there may other things in the D-RAP program that are risk significant but don't fall under the specific criteria for RTNSS, so D-RAP is equal to or larger than RTNSS. And if you have an active plant, which is not the case for NuScale, then there is no RTNSS it's only the D-RAP box.

VICE CHAIRMAN CORRADINI: I just want to, to move on and I'm going to answer Charlie's question a different way. This is one piece of a big process.

We will be back to it. So rest assured you'll have another --

MEMBER STETKAR: When we review Chapter 17 or 19 or wherever their list shows up in the design certification in the SER we'll be visiting that list.

MEMBER BROWN: I'd just like to make sure that the stuff's screened out, at least gets assessed as to why this makes sense. That's all.

MR. CARUSO: Part of the process.

MEMBER BROWN: Okay, and if that's part of the process I'll walk away happy. So as Mike would like to do he wants you to get on with it.

MR. CARUSO: So you're part of the process too so you've got two things going for you. So let's see, where was I?

VICE CHAIRMAN CORRADINI: I think you were at limitations.

MR. CARUSO: Limitations. So in the SER we have a number of conditions and limitations. The approval of the topical is for NuScale only. Like I said, the determination of risk significance for a specific application like the D-RAP is a separate activity. We're going to review that when it comes in.

And as we just discussed, a number of

additional factors, deterministic factors are included in that application. In 3 we talk about the adequacy of the PRA. They need to have a technically accurate PRA that addresses all the external and internal hazards and operating modes. This is actually part of, you know, our guidance in the SRP 19.0.

They also need to account for the impacts on a module, this assessment is done on a module basis for impacts to the sequences for that module that could arise from effects of the other modules.

And I think this, we had a lot of discussion at the subcommittee meeting about this topic, and I think we're committed to come back and have a separate discussion about how we're going to treat and evaluate the impact of module and module in the non-design basis perspective and a design basis perspective.

And then the fourth one I added in to --

MEMBER SKILLMAN: Mark, before you proceed, it seems to me that this Item 3 is the linchpin to the other topic that we were just discussing relative to risk achievement worth and importance.

Here's an example. Let's say this is a NuScale that it's not completely built, only 10 of the

12 modules are in place. Two have been operating for a couple of years, two or three are in the middle of their life, and one or two are shut down for refueling or maintenance.

And so not all are powered, not all are shut down. A couple are producing DKE. Those that have the longest runtimes have the greatest radioisotopic inventory. They all share some equipment of some sort.

And so it seems to me that this PRA needs to account for 12 modules or the number of modules that have fuel in them, the conditions of those modules at the time that PRA or the accident's being assessed, what is being shared among the modules that is important for the operating mode of each of the different modules.

So my hunch is that this becomes an extremely complicated riddle of permutations and combinations. And what makes it, at least in my mind, the most challenging is the fact that when we've gone through the screening criteria beginning with an assumed 10 to the minus 7, NuScale is saying, hey, if I'm at a 3 times 10 to the minus 6 or greater then only those components are screened as safety significant, I might have shared components that are

well below that 3 times 10 to the minus 6 that several of these other modules are depending on and they get lost in this fog.

So what I'm thinking is we've got to make sure that the analytical tool has a magnifying glass that's thick enough to find these very subtle relationships. And maybe that's part of the process and it will come out in the wash, but it all begins with this notion 10 to the minus 7 is so low we can take a pretty good increase and still be safe.

And I would like to hear you speak about that for a minute, please.

MR. CARUSO: Well, yes. I think that the 10 to the minus 7 was focused on if I focus on one module which assumes that I've somehow decoupled them or made interactions through design very, very unlikely, and I can do that.

But I think, you know, that there, the whole issue of interaction between the modules and shared systems is something that is going to have to be a factor in this assessment of systems, like you said.

The fact that -- I mean, we have information on it, I don't know if it's changed or not, that the circ-water system is shared among six

modules. The component cooling water system is shared among six modules.

So anyway, all I would say, I agree with you. I think the information that you get from the PRA is going to be somewhat limited because the PRAs have not been traditionally developed to look at a design like this.

And so I think in the future, you know, a better tool for that part of analysis will be good but we're going to have to live with what we have now. I think NuScale is doing some things in their PRA analysis spectrum to look at multi-module. I don't know exactly what.

We have tried to focus more on we want to understand from a design perspective that, you know, you have looked hard at these couplings and basically through your design made the likelihood of significant multi-module interactions lean to simultaneous core damages go away, be unlikely. And we have that as review guidance in our SRP and it's going to be a challenge, you're absolutely right. It's going to be a challenge to look at this.

But I think the fact, you know, that if they have these systems where, I mean, if I fail the circ-water system and it trips, you know, six units,

the PRA may not say that that should be in the box, but a deterministic perspective, you know, might be different because all of a sudden I have six modules tripping.

And so I'm not saying they're right or wrong. I'm not prejudging anything. But I'm agreeing with you that it's going to be complicated and we are in some territory that we haven't been in before.

MEMBER REMPE: But to sum up your response to that you're saying that part of the standard review plan will address those issues somewhere is your vision that the NRC will as part of this interaction?

MR. CARUSO: Yes. We'll meet with you on the subject of multi-module and we'll go over what's in there, how we got there and how we, you know, will move forward in the review of what we have.

You know, it's not 25 pages of guidance, you know, about details of multi-module, but it basically, it's kind of like if you're familiar with the concept that's kind of big in Europe now, practical elimination, you know, you would really like to do things to practically eliminate potentials for big bad accidents like multi-module core damages.

We essentially said you should focus on making the multi-module concern with your facility,

make it go away as much as you can or as unlikely through design, and show us that you've looked for the things, these vulnerabilities, hard, show that you've done a systematic look for them, and ones that you've found that could be, you know, concerns you're taking some action through design to minimize them. This is the guidance that's in there.

So, you know, this is on our plate to look at in the review, and they basically know that they need to address it. We're actually going to NuScale to do an audit of some of their PRA documentation which they've completed and they do have already. They have a report in there on some treatment of multi-module that we'll be looking at next week. So we're very interested in that.

But it is going to be hard. It's going to be complicated, like I think we are in kind of new waters here.

MEMBER SKILLMAN: But it seems to me that over when we talk about a single reactor, as we've found in reactors that have problems, we always have the ability to focus on that one core as many fuel assemblies are in that core, as are in that core and as many curies are in the core at the time the incident occurs, hence the decay heat generation rate.

It seems to me that maybe one way to approach this is to talk about curies at risk or decay heat quantities at risk. If you have a single core with so much decay heat generation rate available at a certain time you have a pretty good idea of where you're going to have to go to get rid of the heat and what you're going to have to do to bottle up those isotopes.

But here you might have 12 machines, 12 different decay heat generation rates or production rates, and 12 different isotopic burdens, and so maybe a way to approach this is to approach it from the perspective of curies at risk or heat at risk.

And that way you really cut through all the fog and you say this is where my real risk lies, now how can we cool it and how can we contain those curies, because part of this passive design is intended to have passive heat removal and capture those curies.

MR. CARUSO: Right.

MEMBER SKILLMAN: But it seems to me that those, maybe a way to approach this is, may be a slightly different perspective than we think about it today.

MR. CARUSO: Well, I think that's true.

I think there's some aspects of the design that give you some margin at the end. The containment design, the cooling of the containment from the pool in terms of, you know, containment failure probabilities, you still have bypasses, but I think you're right.

MEMBER SKILLMAN: Thank you.

VICE CHAIRMAN CORRADINI: Go ahead.

MR. CARUSO: So this last, this fourth limitation was basically because of the discussion we had at the subcommittee meeting about are you approving importance measures or not approving importance measures or what are you doing?

And we basically were saying we're happy with the concept of getting an importance measure, a different importance measure for a much lower core damage frequency. And we are in fact saying we're okay with the upper bound value of 0.2 for, you know, NuScale. I mean that, if their core damage frequency was to go down farther then, you know, they're not going to raise it beyond 0.2 because they've already said anything beyond 0.2 doesn't make sense.

If the core damage frequency went down, then they would certainly look at scaling back down to a lower Fussell-Veseley. But we're just saying that process of going down, you know, to find it is fine.

I mean, it's basically that's the whole issue of scaling that we talked about.

So I think if you go to Slide 8 we just talked about the issue that we've discussed at the subcommittee meeting on approval of importance measures.

MEMBER BROWN: Mark, when you say go down I'm trying to get a handle. You mean it can't go below 0.2?

MR. CARUSO: No. Yes, it could go below 0.2, not above.

MEMBER BROWN: But it cannot go above, it can't go back up to 0.5.

MR. CARUSO: Right.

VICE CHAIRMAN CORRADINI: You're getting percentages and fractions mixed up, so let me try. It's 0.2, which is 20 percent, versus the current plants which is 0.5 percent or 0.005.

MEMBER BROWN: Right.

VICE CHAIRMAN CORRADINI: I think I've said it correctly.

MR. CARUSO: They had originally derived for, if you take the equation, the definition of Fussell-Veseley and you --

MEMBER BROWN: That's not what the topical

report says. Fussell-Veseley of 0.5 or 50 percent, or Fussell-Veseley of 0.2 or 20 percent, that's what the topical report says.

VICE CHAIRMAN CORRADINI: That's what I just said.

MEMBER BROWN: No, you said one was --

VICE CHAIRMAN CORRADINI: 0.5 is what --

MEMBER BROWN: Is 50.

VICE CHAIRMAN CORRADINI: Just let me try. 0.5 is what it would be if they directly scaled it from the current plants and they took an additional 2-1/2 times lower value to be conservative. Have I said that correctly?

MR. CARUSO: Yes.

MEMBER STETKAR: That's taken what you see, Charlie, down by a factor of a hundred because the power level is down by a factor of a hundred. The core damage frequency is down by a factor of a hundred so it's 0.005 at 10 to the minus 5, it would be 0.5 at 10 to the minus 7. They're using 0.2 at 10 to the minus 7. Now if anybody reads the transcript they can sort through those numbers.

MEMBER BROWN: Let me ask the question another way without those things in there so that my non-quantifiable brain can work with this. If the CDF

went from 10 to the minus 7 to 10 to the minus 6, is that up or down?

MR. CARUSO: The Fussell-Veseley --

MEMBER BROWN: That's --

MR. CARUSO: -- we would have to use would be smaller.

VICE CHAIRMAN CORRADINI: It would go down.

MEMBER BROWN: Would that screen fewer things out?

MR. CARUSO: No. That would screen more things in. Well, I don't know. I don't know if -- yes, I mean it would --

MEMBER BROWN: All I'm trying to do is get consistency. You're saying nothing of what you're going to agree with will not allow it to go one way but you'll allow it to go another way.

MR. CARUSO: Core damage frequency goes up and you used 0.2, 20 percent, that would be a mistake. That would be a mistake. That would -- I think you'd have the wrong answer.

VICE CHAIRMAN CORRADINI: I think staff quantitatively it all makes sense at least to me. I think the way in which it's described when one thing goes down it actually has the potential of putting

more things into the D-RAP candidate list that you are concerned about.

MEMBER BROWN: My wife asked me to increase the air conditioning which means I have to decrease the setting.

VICE CHAIRMAN CORRADINI: Well done.

MEMBER BROWN: And that's why I'm trying to calibrate myself on those two particular sentences.

VICE CHAIRMAN CORRADINI: That's a perfect analogy.

MEMBER BROWN: I just wanted to make sure they were going the right way. They're trying to get rid of stuff, and I'm trying to make sure that if goes in the wrong direction then we ought to be making sure that the possibilities exist that more stuff gets put back into the D-RAP as opposed to whereas if it goes any, you go from 10 to the minus 7 to 10 to the minus 8 it's going to stay at 0.2. Did I say that right?

VICE CHAIRMAN CORRADINI: Yes.

MEMBER BROWN: Okay.

VICE CHAIRMAN CORRADINI: Right.

MR. CARUSO: So I actually think, I think we have covered everything else that's on Slide 8 and I think I went through Slide 9 when I talked about the implementation issues so I would just be repeating

myself.

VICE CHAIRMAN CORRADINI: Okay. If I may, at this point I'd like to ask the NuScale people to come back online, or unmute, and make sure I've not misconstrued anything and have properly represented their topical report. So, Bill?

MR. GALYEAN: Yes, I think the discussion has been on target. I don't have anything additional to add. I mean, we can go off kind of on a tangent on multi-module issues, but I don't think that's what you're looking for here now.

VICE CHAIRMAN CORRADINI: Okay. So if you please stay unmuted, can I go around the table with our members and see if there's any comments either to NuScale or to staff?

Okay. All right, so why don't we now see if anybody's in the room that wants to make a public comment. Seeing none --

MS. MROWCA: I'll make a comment.

VICE CHAIRMAN CORRADINI: Oh, I'm sorry. Lynn.

MS. MROWCA: Hi. This is Lynn Mrowca from NRO, and I just want to make a comment about the discussion on generic risk significant guidance, because we have been listening and we have been

discussing but we have a few questions that we need to answer, for instance, what we would put in where and when.

So we haven't come to a decision or not, but I just wanted to let you know that we are listening and we understand the point that it would make our reviews more efficient, it would give future applicants an idea of what we're looking for, so we understand all the benefits, it's just a matter of answering those questions before we do anything.

VICE CHAIRMAN CORRADINI: Okay. All right, thank you very much. I appreciate that. Can we turn on the public, or unmute the public line and see if there's comments from folks on the phone please?

So if somebody's on the public line could you please just speak up and just let us know you're there.

MR. LEWIS: Marvin Lewis, member of the public.

VICE CHAIRMAN CORRADINI: Marvin.

MR. LEWIS: No comment.

VICE CHAIRMAN CORRADINI: No comment?

CHAIRMAN BLEY: Thank you for answering.

VICE CHAIRMAN CORRADINI: Thank you,

Marvin, very much for answering. Okay, we can -- anybody else on the public line that wants to make a comment? Okay, we can close the public line and I'll turn it back to the chairman. Dr. Bley.

CHAIRMAN BLEY: Thank you very much. I better look before I make another faux pas. We'll be going off the record now for the day, or for the meeting, and we'll come back at 2:30 to start on the letters. Your letters ready?

VICE CHAIRMAN CORRADINI: Yes.

CHAIRMAN BLEY: You have two letters ready? 2:30, we'll recess until then and we're off the record for the week.

(Whereupon, the above-entitled matter went off the record at 2:14 p.m.)

U.S.NRC

United States Nuclear Regulatory Commission

Protecting People and the Environment

JLD-ISG-2016-01 Guidance for Flooding Hazard Focused Evaluation and Integrated Assessment

ACRS Full Committee

Eric E. Bowman

May 5, 2016

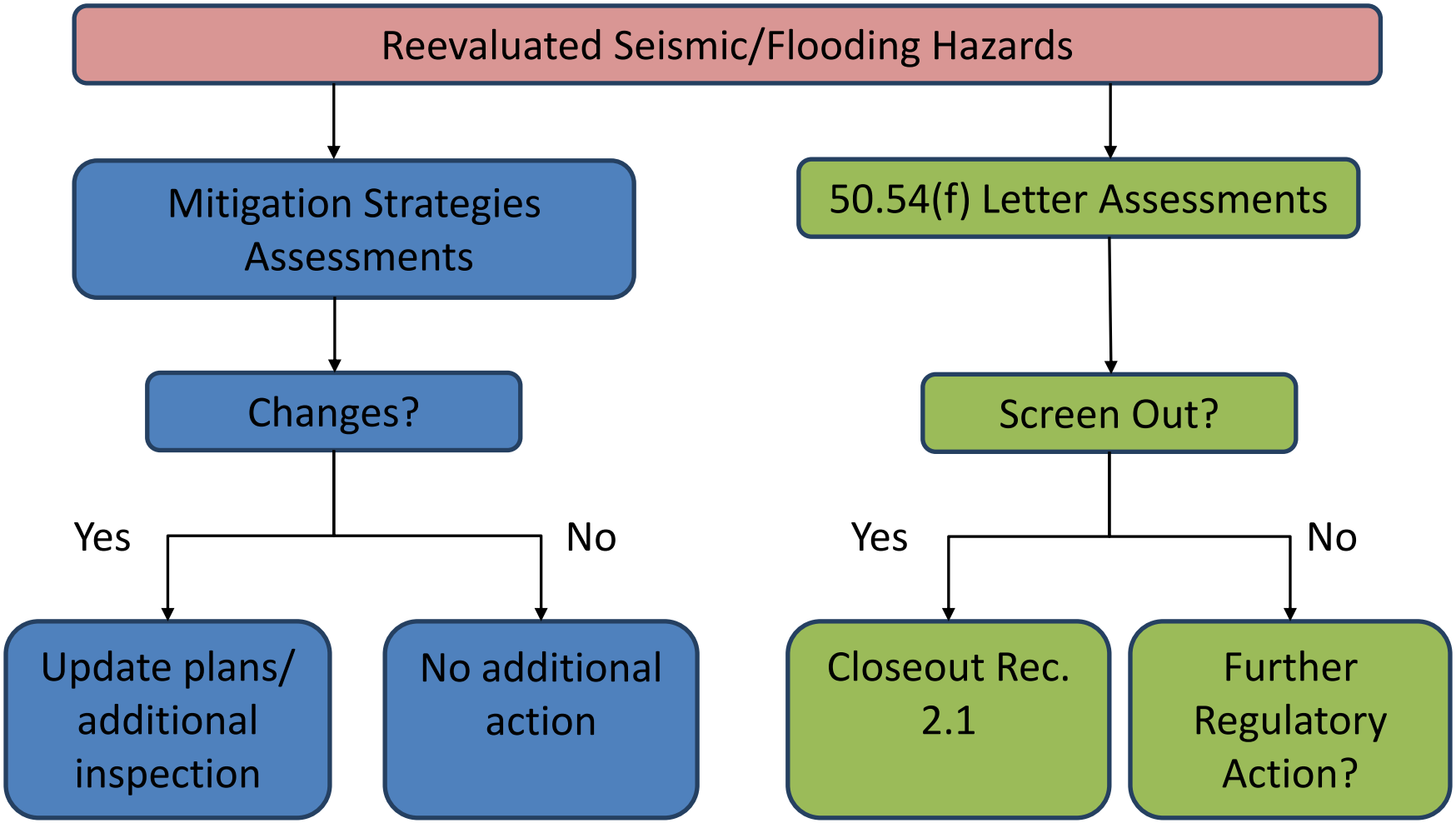
U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Purpose

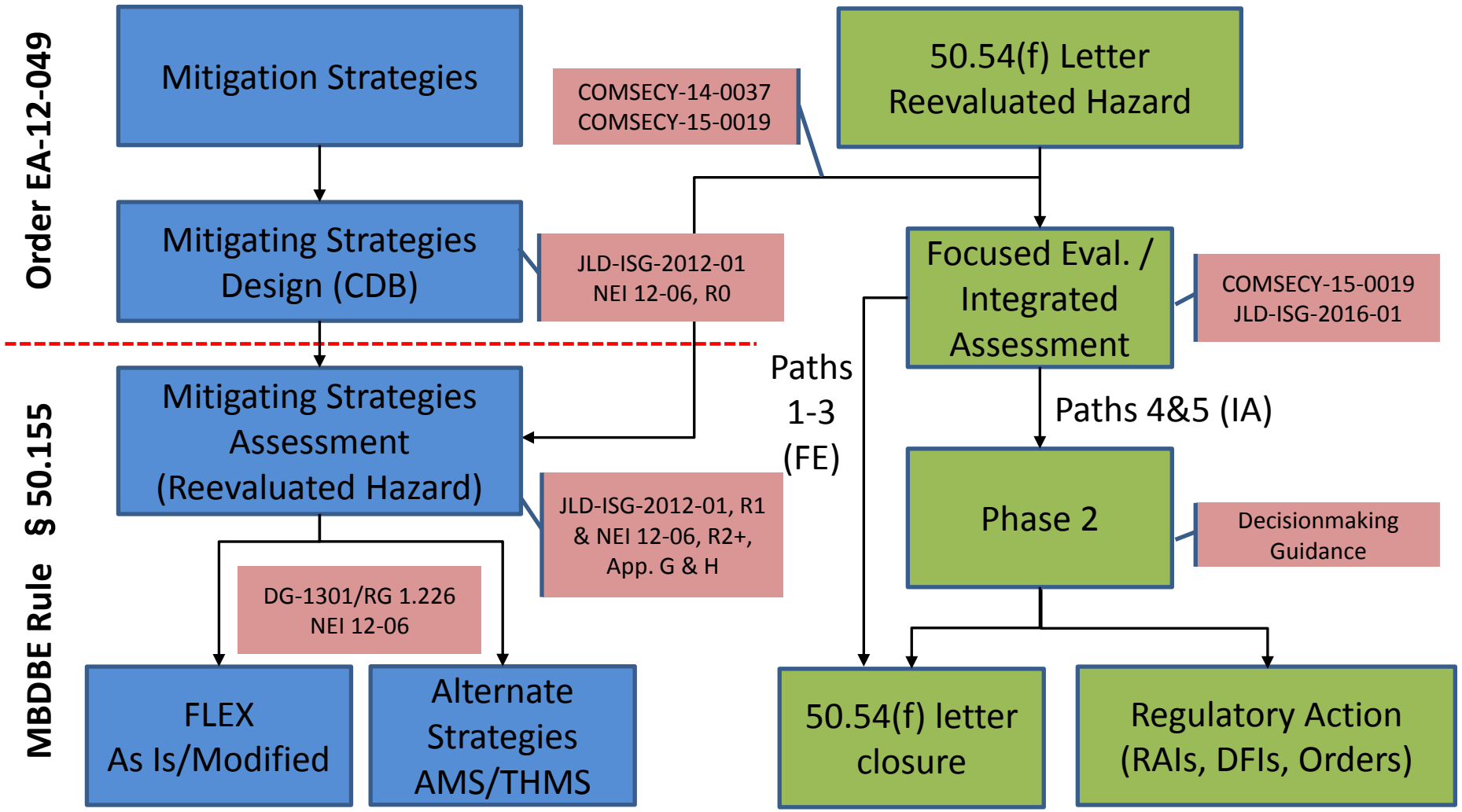
- To provide guidance for closure of flooding hazard reevaluations by:
  - Endorsing NEI 16-05 with clarifications in order to provide a graded approach to identify the need for, prioritization, and scope of, integrated assessments.
- Guidance for making regulatory decisions for integrated assessments will be issued separately.

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

Closure of Seismic and Flooding Hazard Reviews



Interaction of Mitigating Strategies and Reevaluated Hazards



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

Anticipated Regulatory Outcomes

- Under 50.54(f) Letter:
  - Interim actions addressing hazard
  - Commitments to justify improved realism:
    - Plant modifications
    - Programs and Procedures
  - Phase 2 Regulatory decisions
- Under MBDBE Rule:
  - Mitigating strategies for hazard without change to improve realism

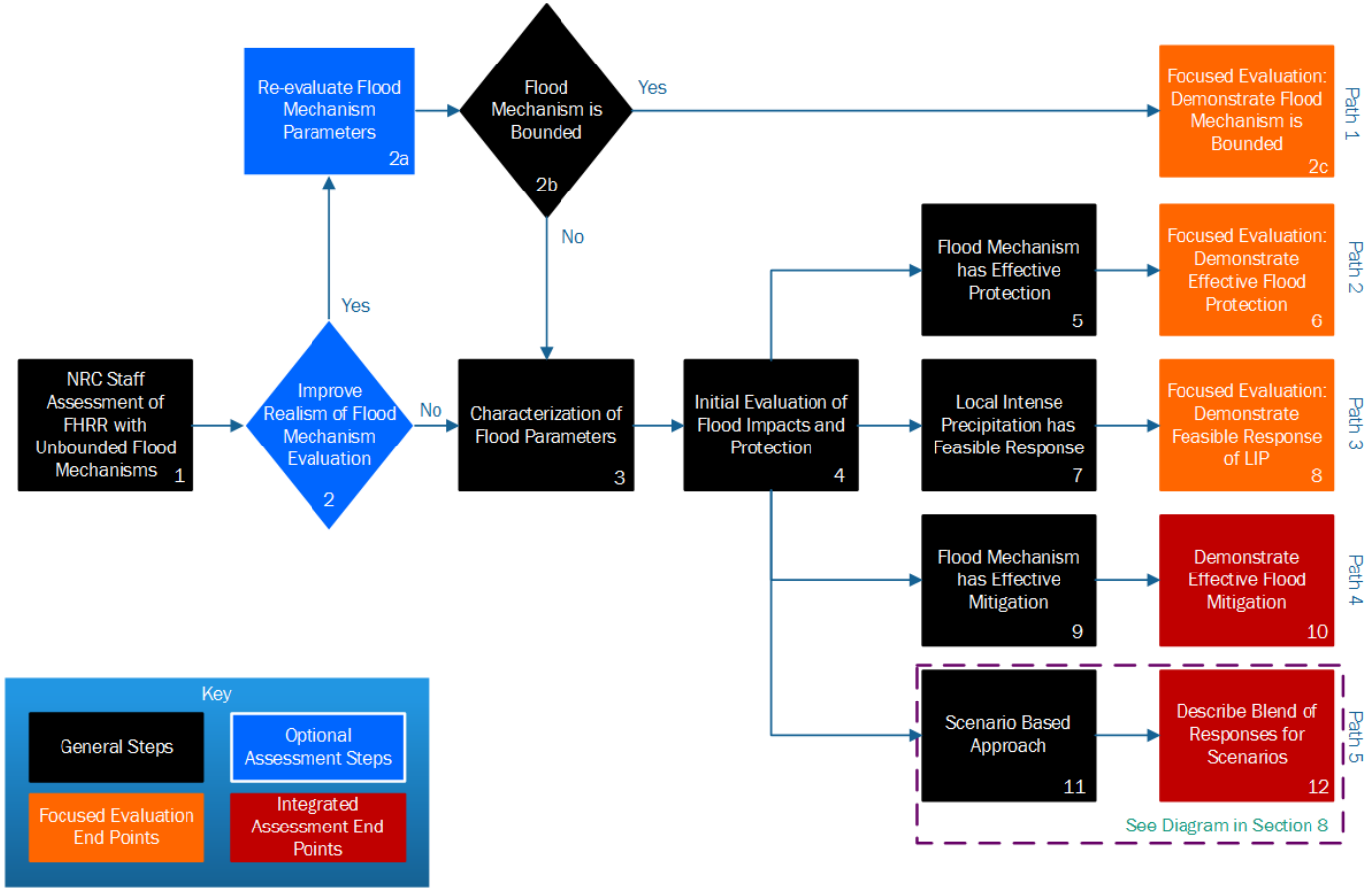
U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Industry Proposed Guidance: NEI 16-05

- JLD-ISG-2016-01 issued in draft form by Federal Register Notice dated April 22, 2016 (81 FR 23758)
- Comment period runs through May 23, 2016
- Docket Number: NRC-2016-0084

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

NEI 16-05 Flood Impact Assessment Process



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

Reductions of Conservatism

- SRM-COMSECY-15-0019: "[S]taff should continue to look for additional opportunities to address any over conservatism."
- Method: NUREG/CR-7046 HHA Process
- Catalog of potential sources of conservatism in NEI 16-05, App. A to consider in HHA
  - Site-specific consideration of changes

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

Initial Evaluation of Impact and Protection

- NEI 16-05, Section 6.3.1 is acceptable

Determination of Available Physical Margin

- NEI 16-05, Section 6.3.2 and Appendix B are acceptable with clarifications
  - The considerations of the December 23, 2013 RAI (ML13325A891) should account for the reevaluated flood parameters rather than the current licensing basis flood height
  - Reliability of temporary features should consider operating experience

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

Path 1 – Bounded by Design Basis

- Licensees may use bounding sets of flood parameters to disposition groups of flood mechanisms, leaving others to be dispositioned by other paths

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

Path 2 – Effective Flood Protection

- NEI 16-05, Section 7.2 and App. B & C are acceptable with clarifications:
  - Resulting qualitative evaluation of site response will be reviewed using engineering judgment (*See* COMSECY-15-0019)
  - The considerations of the December 23, 2013 RAI (ML13325A891) should account for the reevaluated flood parameters rather than the current licensing basis flood height

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

NEI 16-05, Appendix C, Evaluation of Overall Site Response

- Relies on Feasibility Determination using NEI 12-06, Appendix E, Validation Guidance
- Consistent with Commission Policy and Regulation on Fire Protection Operator Manual Actions as Expressed in 10 CFR 50.48(c); NFPA 805-2001, § 4.2.4.1.6; and NFPA 805-2001, § B.5.2 as endorsed by the Standard Review Plan NUREG-0800, Chapter 9.5.1.2, Section III.3.2.2.
- NRC staff intent is to balance the burden imposed in evaluating site response with the state of the art in determination of flooding frequencies in order to allow exercising qualitative engineering judgment as described in COMSECY-15-0019 and its associated SRM in the absence of fully developed quantitative information on flooding risk.

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

Path 3 – Local Intense Precipitation

- NEI 16-05, Section 7.3

As discussed in COMSECY-15-0019, “licensees [with LIP hazards exceeding their current design-basis flood should] assess the impact of the LIP hazard on their sites and then evaluate and implement any necessary programmatic, procedural or plant modifications to address this hazard exceedance. This assessment includes evaluation and justification for: crediting systems that were assumed clogged during the hazard reevaluations; and considering available warning time and flood protection measures, both permanent and temporary, as well as associated manual actions.” Licensees may use the process described in the NEI White Paper, “Warning Time for Maximum Precipitation Events,” dated April 8, 2015 (ADAMS Accession No. ML15104A157), and the related NRC letter dated April 23, 2015 (ADAMS Accession No. ML15110A080) in order to take advantage of warning time for LIP.

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

Path 3 – Local Intense Precipitation

- Licensees should assess protection of key SSCs as defined in NEI 16-05 with the considerations described above. Protection should include considerations described in Appendix B. If the key SSCs cannot be protected from the LIP hazards, licensees should attempt to mitigate the impact of the LIP on key SSCs. Demonstration of mitigation capability could include reliance on the mitigating strategies assessment LIP evaluation.

- NRC staff reviewing the plant response evaluation for LIP should apply engineering and operational judgment.

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

Path 4 – Demonstrate Effective Mitigation

- NEI 16-05, Section 8.1
- Licensees should provide corresponding information to address critical flood elevations from NEI 16-05, Section 6.3.1, including frequencies of exceedance

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

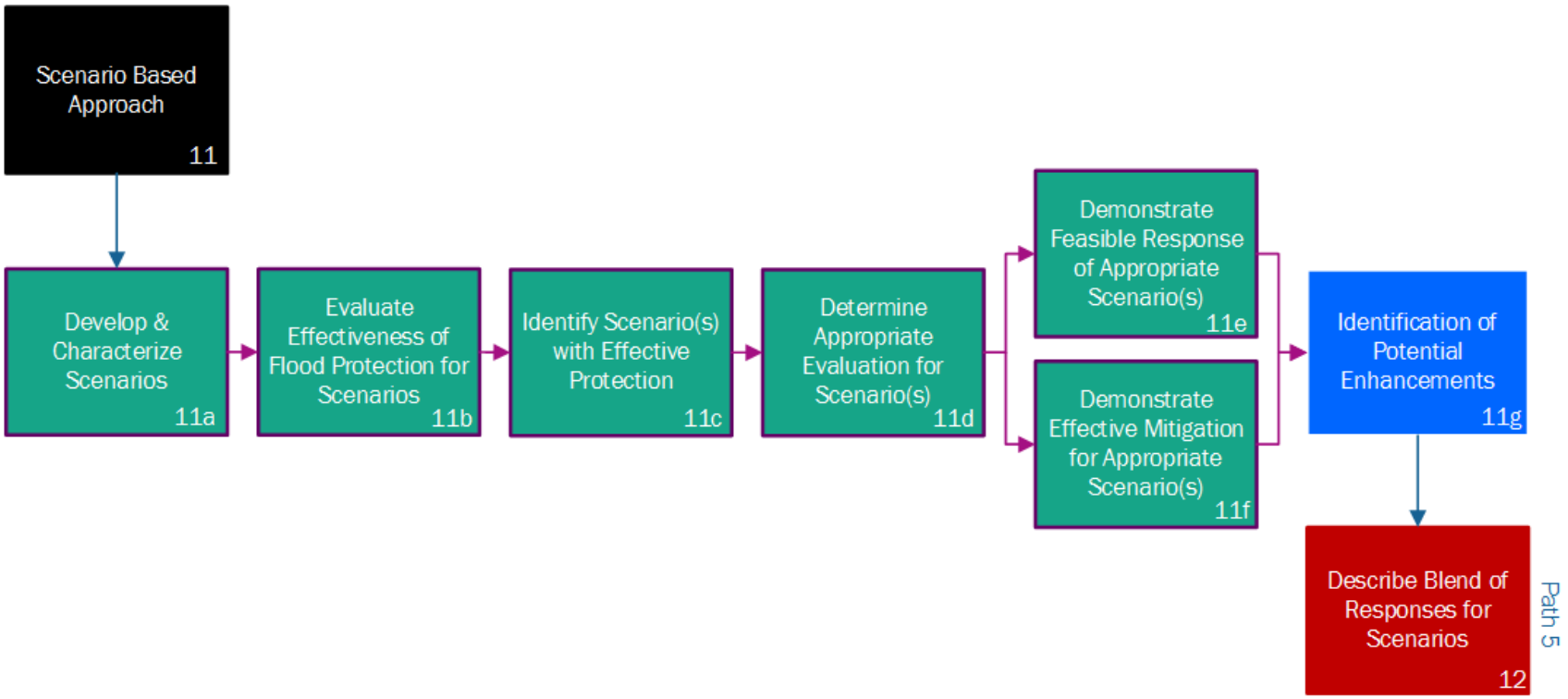
Path 4 and Path 5 Frequency Determinations

a. Appendix D, Section D.2, compiles selected methods and references related to developing a probabilistic characterization of flooding hazards that have been used primarily in applications not related to nuclear power plants. When applying methods and references provided in Section D.2, licensees should assess the methods and references to:
   - Verify that that references have not been superseded or rescinded due to identified technical inadequacies or shortcomings. Limitations on rescinded references do not apply to documents that have been administratively withdrawn for reasons not related to technically adequacy (e.g., due to administrative schedules associated with Standards).
   - Ensure context and caveats related to the numerical values in Table D-1 (as described in USBR, 2004) and Figure D-1 as well as the methods and references described in Table D-2 are addressed.

b. To establish the frequency of exceeding a given measure of flood severity, the licensee should aggregate the contributions from a range of potential flooding mechanisms and relevant contributing events and should not limit the assessment to development of frequencies associated with deterministic event combinations (e.g., combinations identified in NUREG/CR-7046) shown in Section D.3.

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

NEI 16-05 Path 5 Detail



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

Path 5 – Scenario-Based Approach

- NEI 16-05, Section 8.2 and App. D
- Scenarios developed should include critical flood elevations
- Identification of scenarios with effective flood protection should include path 2 considerations of NEI 16-05 and ISG
- Frequencies of exceedance should be developed with a methodology that conforms to App D, taking into account PFHA attributes and clarifications of ISG

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

Backup

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

Coupled Seismic and Flooding

- Seismic dam failure addressed in NTTF 2.1 Flooding
- Seismic dam failure to be further addressed in NTTF 2.1 Seismic for SPRA plants
- Plant equipment (SSCs) addressed in both NTTF 2.1 Flooding and Seismic
- Plants with dams in proximity typically examined seismically induced flooding although not an explicit part of mitigating strategies guidance

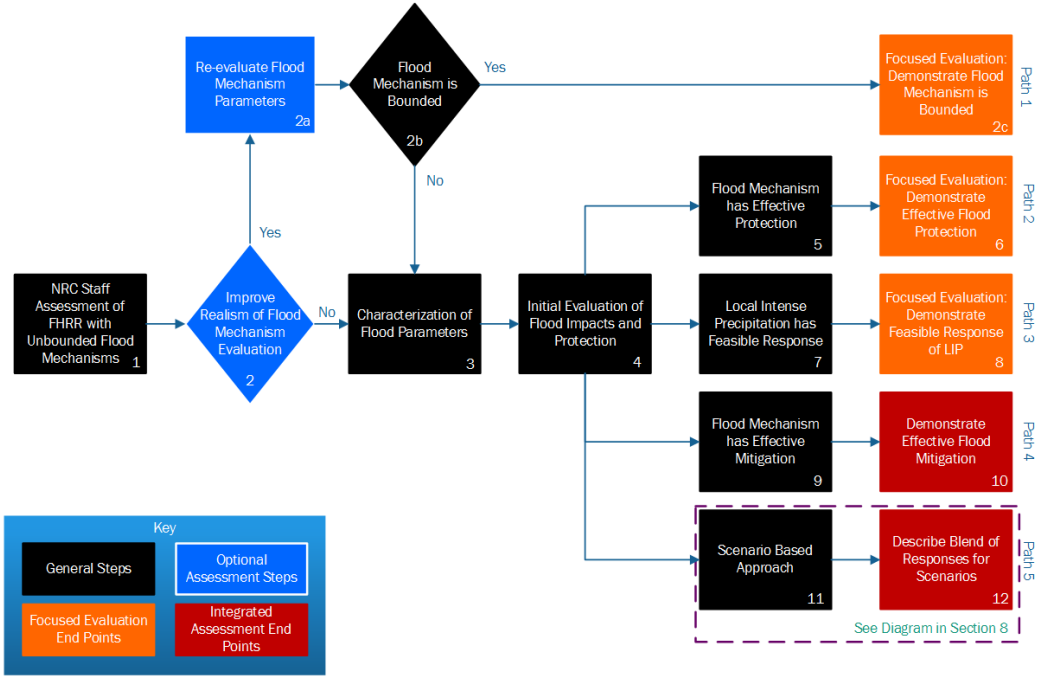
Comments on JLD-ISG-2012-01 endorsement of NEI 16-05

NEI Fukushima Flooding Task Force

ACRS Meeting

May 5, 2016 • NRC Headquarters White Flint

Flooding Impact Assessment Process



Flooding Impact Assessment Process

Path	Required level of Evaluation	Elements to be Evaluated	Relevant Guidance
Path 1 (Section 7.1)	Flood Hazard Evaluation	Flood Mechanism Parameters	NEI 16-05 Appendix A
Path 2 (Section 7.2)	Effective Flood Protection	Available Physical Margin	NEI 16-05 Appendix B
		Reliability of Protection Features	NEI 16-05 Appendix B
		Overall Site Response	NEI 16-05 Appendix C
Path 3 (Section 7.3)	Feasible Flood Response for LIP (Protection and/or Mitigation)	Reliability of Protection Features and Mitigation Equipment	NEI 12-06
		Feasibility of Manual Actions	
Path 4 (Section 8.1)	Effective Flood Mitigation	Reliability of Mitigation Equipment	NEI 16-05 Appendix B
		Overall Site Response	NEI 16-05 Appendix C
Path 5 (Section 8.2)	Scenario Based Approach (Blend of Responses)	Various	Various

IA Path 4: Effective Flood Mitigation

- Process steps for each mechanism:
  - Demonstrate that the mitigation equipment is reliable (Appendix B)
  - Demonstrate overall site response is adequate (Appendix C)
- Intended to be utilized for sites with mechanisms where site-specific frequency development would be challenging (e.g. dam failure)

ISG Clarification on Path 4

- *Information submitted to the NRC should include the frequency of exceedance for the critical flood elevations or (if appropriate) should identify that the frequency of exceedance for the critical flood elevations is estimated to be less than 1E-4/year.*

Level of Complexity for Frequency Development

- Lower Complexity – Precipitation and river type mechanisms should be able to apply Bulletin 17B with possible validation using another distribution function
- Higher Complexity – Situations where upstream dam failure is the governing flood mechanism
  - Very large effort for frequency development
  - Lack of accepted methodology
  - Lack of access to dam information from USACE
- Requiring Likelihood makes Path 4 and 5 the same

ISG Clarification for Frequency Development

- *NEI 16-05, Appendix D provides available methods for estimating frequencies greater than 10-4/year. When applying these methods, the licensees should consider the attributes described in Enclosure 2*

Comments on ISG Enclosure 2

- Enclosure 2 provides high level overview guidance for PFHA which is not needed for the flooding assessment
- Including Enclosure 2 in the ISG causes confusion as specific attributes needed and how to address are not identified
- Implementation of peer reviews will prove very difficult due to:
  - Limited flooding expert resources
  - Lack of peer review process

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

NRC Staff Preliminary Assessment of Natural Hazards other than Flooding and Seismic

ACRS Full Committee Meeting
May 5, 2016

Japan Lessons Learned

Background

- Resolution plan for remaining Tier 2 and 3 activities provided in SECY 15-0137, “Proposed Plans For Resolving Open Fukushima Tier 2 and 3 Recommendations”
- Natural Hazards other than Seismic and Flooding binned as Group #3 activity in SECY 15-0137
  - More detailed assessment and/or justification for resolution being prepared; ACRS/external stakeholder interactions would inform resolution of the recommendation; work to be completed in 2016
- Commission decision on SECY-15-0137
  - Other Natural Hazards interim status to be provided end of May 2016
    - Commission directed that the interim status include the results of the staff’s assessment through step 2 of the process outlined in SECY-15-0137

Background

- Staff plans to meet Commission direction for assessment of natural hazards other than seismic and flooding
  - White paper providing the staff's preliminary assessment publicly issued on March 24, 2016 (ADAMS Accession No. ML16039A054
  - Category 3 public meeting held on April 5, 2016, to solicit comments on white paper
  - ACRS Fukushima Subcommittee briefed on April 21, 2016, action items from the meeting include:
    - Provide updated assessment reflecting additional changes the staff is considering as a result of stakeholder comments (completed via transmittal of updated draft assessment in memorandum dated April 26, 2016 (ADAMS Accession No. ML16117A041)
    - Provide discussion of status of NRC geomagnetic storm activities during May 5, 2016, ACRS Full Committee meeting
    - Several items provided by ACRS members for NRC Staff consideration (to be discussed in following slides)
  - Staff plans to provide an updated interim assessment by end of May 2016 in accordance with Commission direction
  - Staff targeting providing final assessment to the Commission by end of December 2016

Background

- Based on ACRS and other stakeholder comments, staff considering adding an appendix to describe comment and staff's resolution of comment. Issues identified to date include the following:

Item #	Issue
1	Hurricane evaluation should consider warning time, and attributes of a hurricane that make it unlikely to lift an automobile. Staff should also consider that automobile missiles represent surrogate missiles.
2	Staff should identify plants by names that are the subject of the snow load and high wind evaluations
3	Document should include updated Electric Power Research Institute (EPRI) guidance for natural hazards
4	Low water evaluation for Robinson should address Reactor Coolant System (RCS) inventory control strategies
5	Low water evaluation for seiche should address RCS inventory control strategies
6*	The staff should also consider the possibility of the natural hazard alone creating a loss of access to the ultimate heat sink (UHS).

* Indicates ACRS member comment from April 21, 2016, Fukushima Subcommittee meeting

Background

- Stakeholder comments continued

Item #	Issue
7*	Columbia volcanic ash assessment should address plant's capabilities to respond to byproducts of a volcano.
8*	The staff should consider addressing the nexus between the waterspout evaluation and the tornado evaluation.
9*	The staff should consider whether the mitigation strategies guidance addresses the possibility of a seismically qualified dam overtopping and failing.
10*	The staff should consider whether the mitigation strategies addresses the possibility of seismic failure of an upstream dam coincident with the seismic event affecting the power plant.
11*	The staff should consider for its low water seiche assessment whether coastal plants are susceptible to this condition because of the arrangement of their ultimate heat sink.
12*	The staff should consider whether the dust storm evaluation should consider the potential of the plant being affected by small particles that could interfere with the operation of the plant.

* Indicates ACRS member comment from April 21, 2016, Fukushima Subcommittee meeting

Overview of 4 Step Process for Evaluation of Other Natural Hazards

Four Step Process

1) Define natural hazard other than seismic and flooding to determine those hazards that could pose a threat to nuclear power plants

2) Determine and apply screening criteria to exclude certain natural hazards from further generic evaluations, or exclude some licensees from considering certain hazards

3) Perform a technical evaluation to assess the need for additional actions if the hazard or licensee was not screened out generically in Task 2
   - Consider whether a request for information in accordance with 10 CFR 50.54(f) is appropriate (approach taken for seismic and flooding)
   - Enough information at this stage to require action in accordance with 10 CFR 50.109 (backfit process)

4) Based on results of Task 3, determine if additional regulatory actions are needed

Preliminary Results of Step 1 Assessment

- Hazards identified for consideration found in Appendix A of white paper
- Man-made hazards excluded from further consideration
- Natural hazards listed in Appendix A Table A-1
- Natural hazards excluded from further consideration (basis provided in Appendix A) include:

Animals	Avalanche	Biological Events, coastal erosion, ice barrier, ice cover, biological plugging of intakes
Corrosion	External flooding*	Extreme air pressure
Fog/mist, frost, hail, landslide	Dust storms, forest fire, grass fire, ice storm/freezing rain, sleet, lightening, sandstorms, salt storm	Land rise, sink holes, soil shrink-swell, underwater landslide (impact on soil, that is not a tsunami)
Meteorite	Seismic activity*	Geomagnetic storms**
Waterspout	Volcanic activity**	

*Seismic and Flooding being evaluated in accordance with Recommendation 2.1

** Additional discussion regarding geomagnetic storms and volcanic activity on next slide

Geomagnetic Disturbances

- Mitigation of Beyond Design Basis Event (MBDBE) Rulemaking
  - Discusses geomagnetic disturbances
  - References petition for rulemaking (PRM) 50-96
  - NRC received comments on geomagnetic disturbances in response to MBDBE proposed rule and is in the process of assessing comments
- PRM 50-96 – in addition to being referenced in MBDBE proposed rule, the NRC staff will follow the PRM process for resolving the concern
- Other Federal Activities
  - Federal Energy Regulatory Commission (FERC) geomagnetic disturbances rulemaking
    - Proposed rule published in Federal Register on May 26, 2015 (80 FR 29990)
  - NRC staff members part of space weather operations, research, and mitigation (SWORM) task force
    - White House Office of Science and Technology Policy (OSTP) leading effort to implement National Space Weather Strategy (NSWS) and National Space Weather Action Plan that were issued October 2016: https://www.whitehouse.gov/sites/default/files/microsites/ostp/final_nationalspaceweatherstrategy_20151028.pdf)

      https://www.whitehouse.gov/sites/default/files/microsites/ostp/final_nationalspaceweatheractionplan_20151028.pdf

Preliminary Results of Step 1 Assessment

- Natural Hazards reviewed in accordance with Step 1 (continued)
  - Hazards proposed to proceed to Step 2 of the process
    - Wind and missile loads from tornadoes and hurricanes
    - Snow and ice loads for roof designs
    - Drought and other low water conditions
    - Extreme temperatures

Preliminary Results of Step 2 Assessment

- Wind and missile loads from hurricanes and tornadoes and snow loads move to Step 3 of the process
- Drought and other low water conditions and extreme temperatures evaluated as part of Step 2

Preliminary Assessment of Low Water Conditions

- Three low water conditions evaluated
  - Drought
  - Low water conditions due to downstream dam failure
  - Low water conditions due to a seiche
- Criteria applied include
  - Conservatism of design
  - Operational limits
  - Warning time

Preliminary Assessment of Low Water Conditions

- Drought
  - Warning time would allow licensees to take appropriate actions
- Low water conditions due to downstream dam failure
  - Staff addressed as pre-generic issue (next slide)
  - Pre-generic issue closed by March 11, 2016, letter based on:
    - Plants with non-seismically qualified downstream dam developed mitigating strategies to cope
    - Risk assessment performed for plants with seismically qualified downstream dams
      - All sites screen out except Robinson
  - Conclusion:
    - Generic regulatory action to address downstream dam failures not warranted
  - Robinson has been evaluated separately considering:
    - Capabilities of deepwell pumps
    - Newly-installed SHIELD seals
    - Further evaluation as part of NTTF 2.1 activities

Preliminary Assessment of Low Water Conditions

- Low water conditions due to a seiche
  - Staff addressing as part of pre-generic issue
    - March 18, 2015, Region III letter identified possible generic issues (ADAMS Accession No. ML15078A284)
    - One concern is storm can cause low water level conditions that result in damage to safety related ultimate heat sink pumps
    - Plants along the Great Lakes and Chesapeake Bay evaluated
  - Staff evaluation of sites that could be impacted
    - Majority of sites do not rely on UHS for FLEX or have at least a 24 hour water supply (outlasts seiche) before UHS is needed to provide decay heat removal capabilities via FLEX
      - FLEX can provide cooling when UHS water level recovers
    - Units that do not have 24 hour water supply are dispositioned using a combination of hazard and site-specific conditions
  - Preliminary Conclusion
    - Additional regulatory action to address seiche not warranted

Preliminary Assessment of Low Water Conditions

Low water conditions due to a seiche (continued)

- Changes that the staff is considering to the assessment as a result of stakeholder comments:
  - Adding a discussion of how reactor coolant system inventory control could be maintained in the event of the loss of the safety-related ultimate heat sink
    - Use of low leakage reactor coolant pump seals
  - Specific discussion of plants that do not have 24 hours of water on-site
  - Based on ACRS member comment during April 21, 2016, Fukushima Subcommittee meeting staff evaluating coastal sites that could be susceptible to a seiche

Preliminary Assessment of Extreme Temperatures

- Extreme Temperature Assessment considered high and low extreme temperatures
  - Extreme high-temperature
    - Evaluation considered technical specification requirements
      - Example technical specifications includes ultimate heat sink, containment air temperature and control room emergency air temperature
    - If air temperatures outside of design-basis temperature are expected, licensees are expected to take actions
    - Subject to NRC inspection
    - Mitigation strategies equipment consider potential impacts of high temperature (both procurement and operation (e.g., consideration of expansion of sheet metal))

Preliminary Assessment of Extreme Temperatures (continued)

- Extreme low-temperature
  - If air temperatures outside of design-basis temperature are expected, licensees are expected to take actions
  - Information notices associated with cold temperatures
    - IN 96-06 on degradation of cooling water systems due to icing
    - IN 98-02 on cold weather protective measures
  - Subject to NRC inspection
  - Mitigation strategies equipment consider potential impacts of low temperature (both procurement and operation (e.g., consideration of ice blockage and frazil ice))
- Preliminary Conclusion
  - Additional regulatory action to address extreme temperatures not warranted

Preliminary Results of Step 3 Assessment

- Wind and missile loads from hurricanes and tornadoes and snow loads move to Step 3 of the process
- Staff identified issues
  - New guidance provided in both areas after current operating fleet began operation
  - Preliminary assessment includes a discussion of the issue and staff's preliminary process for evaluating issues
  - Staff to provide complete assessment to the Commission by end of December 2016

Preliminary Results of Step 3 Assessment

- Snow loads
  - DC/COL Interim Staff Guidance 007, “Assessment of Normal and Extreme Winter Precipitation Loads on Roofs of Seismic Category I Structures,” issued July 1, 2009, provides guidance for:
    - Calculating 100 year snow loads
    - Calculating extreme snow loads
      - Combination of 100 year snow load and 48 hour probable maximum precipitation event
  - As part of Task 3 the staff will continue to assess design conservatism and warning time (including actions licensees take in the event of an extreme snow event) to determine if additional regulatory actions are warranted

Preliminary Results of Step 3 Assessment

- Wind and missile loads from hurricanes and tornadoes
  - New guidance documents recently issued
    - Regulatory Guide 1.76 Revision 1 on design-basis tornadoes and tornado missiles issued in March 2007
    - Regulatory Guide 1.221 on design-basis hurricanes and hurricane missiles issued in October 2011
  - RG 1.76 Rev 1 tornado wind speeds generally went down
    - Different missile spectrum from 1975 version of standard review plan
    - Automobile missile speeds for same weight automobile went up in some areas

Preliminary Results of Step 3 Assessment

- Wind and missile loads from hurricanes and tornadoes (continued)
  - RG 1.221 hurricane
    - Hurricane wind speeds generally bound by tornado wind speeds for a given site
    - Hurricane missile speeds higher than comparable tornado for sites susceptible to hurricanes
      - Hurricane-generated missile has longer time in hurricane wind field than tornado wind field
  - Staff assessment consists of:
    - Evaluation of Pre-General Design Criteria Plants
    - Plants evaluated against 1975 version of the standard review plan

Preliminary Results of Step 3 Assessment

- Wind and missile loads from hurricanes and tornadoes (continued)
  - Staff Assessment continuing as part of Task 3
    - Consider insights gained from past IPEEEs and current high wind studies
    - Gain further understanding of licensees anticipatory actions in preparation for approaching hurricanes
    - Updated assessment to be completed by December 2016

Next Steps

- Make adjustments to assessment based on ACRS feedback
- Provide updated assessment to Commission by end of May 2016
- Completed assessment due to Commission by end of December 2016
  - Staff envisions public meeting(s) in the summer to discuss snow load and wind load assessments
  - Assessment will be updated based on stakeholder interactions and the results of additional analysis that the staff is considering
  - Engage ACRS in the fall of 2016 based on updated assessment

Acronyms

- ACRS – Advisory Committee on Reactor Safeguards
- ADAMS – Agencywide Documents Access and Management System
- CFR – *Code of Federal Regulations*
- COL – Combined License
- DC – Design Certification
- EPRI – Electric Power Research Institute
- FERC – Federal Energy Regulatory Commission
- FLEX – diverse and flexible coping capability
- IPEEE– Individual Plant Examination of External Events
- ISG – Interim Staff Guidance
- MBDBE – Mitigation of Beyond-Design-Basis Events
- NRC – Nuclear Regulatory Commission
- NSWS – National Space Weather Strategy
- NTTF – Near-Term Task Force
- OSTP – Office of Science and Technology Policy
- RCS – reactor coolant system
- RG – Regulatory Guide
- SECY – Office of the Secretary of the Commission
- SWORM – Space Weather Operations, Research and Mitigation Task Force
- UHS - ultimate heat sink

U.S.NRC

United States Nuclear Regulatory Commission

Protecting People and the Environment

NuScale Topical Report: Risk Significance Determination

Mark Caruso

PRA and Severe Accident Branch

Office of New Reactors

Presented to ACRS

May 5, 2016

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

Overview of Presentation

- Summary of Topical Report
- Staff Evaluation
  - Bases for acceptance
  - conditions and limitations placed on use of topical report
- Discussion of issues raised at Subcommittee meeting

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

Summary of Topical Report

- **Proposes NuScale specific criteria for assessing risk significance**
  - component risk-significant if conditional CDF (CCDF) > 3 x 10-6/yr or LRF (CLRF) > 3 x 10-7/yr
  - system risk-significant if CCDF > 1 x 10-5/yr or CLRF > 1 x 10-6/yr
  - Risk-significant if total FV > 0.20
    - CDF and LRF

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

Reasons for NuScale Specific Criteria

- Current criteria endorsed by staff based on level of risk in operating reactors and not valid for designs showing very little risk
- For low risk plants the traditional relative criteria identify as important structures, systems, and components (SSCs) that don’t really impact the risk results

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

Technical Bases for Criteria

- Consistent with RG 1.174 criteria for permanent licensing basis changes: ΔCDF between 10-5/yr and 10-6/yr considered if CDF < 1 x 10-4/yr
- Component level versus system level adjustment in-line with industry practice (NEI 00-04)

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

Staff's Findings

- Using risk metrics based on absolute changes in risk in conjunction with base CDF and base LRF is OK because it's consistent with guidance in RG 1.174
- Threshold of 3×10^{-6} per year is OK because it's consistent with threshold used in RG 1.174 and NRC regulatory analysis guidelines
- Importance measures (e.g., RAW, FV) may be scaled based on consequence metrics (CDF, LRF) and conditional risk thresholds
- Selection of .2 as upper bound on FV is reasonable
- Allowance for uncertainty in PRA is reasonable
- Selection of threshold for system level basic events consistent with industry practice accepted by NRC
- LRF threshold an order of magnitude below the threshold for CDF is consistent with the approach taken in RG 1.174 and NRC's goal for conditional containment failure in advanced reactors (< 0.1)

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

Conditions and Limitations on Approval

1. Approval is specific to the NuScale design.
2. Applicant or licensee may compare criteria with PRA results to identify candidate risk-significant SSCs; determination of risk-significance for specific applications will consider additional factors and is reviewed independently.
3. Applicant or licensee must use technically adequate PRA for single module that addresses internal hazards and external hazards, and all operating modes, including low-power and shutdown; PRA must account for contribution to single module CDF and LRF from events or conditions in other modules.
4. Approval is for method of deriving values for importance measures, not specific values of importance measures themselves.

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

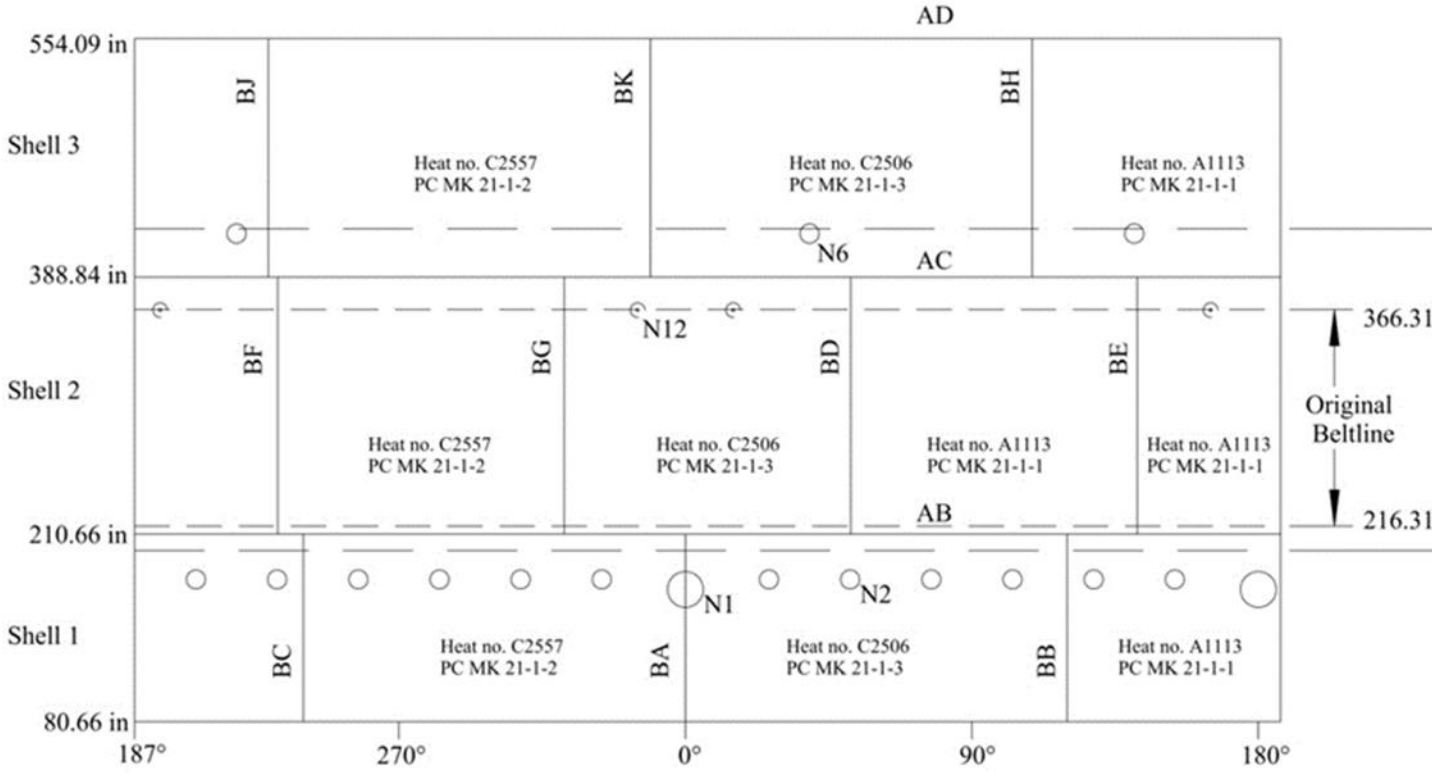
Issues Raised at Subcommittee Meeting

- Approval of importance measures or not?
  - RAW – no
  - F-V – upper bound only
- Ad hoc approach to scale-able criteria
  - Risk Achievement
    - Thresholds proposed for CDF and LRF independent of base values (no RAW needed)
  - F-V
    - Will scale as CDF and LRF go up
    - Not if CDF and LRF go down
- Implementation of SSC categorization
  - Criteria apply at component level or basic event level?
  - Fussell-Vesely importance measures applied on a hazard specific basis

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

Implementation Issues

- SER says implementation for specific applications done case-by-case
  - SSC categorization for D-RAP reviewed as part of design certification review
- Industry techniques for using importance measures to risk-rank SSCs in NEI 00-04 (rev 0)
- Staff endorsed use of NEI 00-04(rev 0) in guidance (Regulatory Guide (RG) 1.201) for implementation of 10 CFR 50.69, “Risk-Informed Categorization and Treatment of SSCs for Nuclear Power Reactors”
- Staff specifies RG 1.201 as acceptable approach for D-RAP categorization in Standard Review Plan Section 17.4, “Reliability Assurance Program”


AD
554.09 in
BJ
BK
BH
Shell 3
Heat no. C2557
PC MK 21-1-2
Heat no. C2506
PC MK 21-1-3
Heat no. A1113
PC MK 21-1-1
N6
AC
388.84 in
366.31
BF
BG
N12
BD
BE
Shell 2
Original
Beltline
Heat no. C2557
PC MK 21-1-2
Heat no. C2506
PC MK 21-1-3
Heat no. A1113
PC MK 21-1-1
Heat no. A1113
PC MK 21-1-1
AB
210.66 in
216.31
N1
N2
Shell 1
BC
BA
BB
Heat no. C2557
PC MK 21-1-2
Heat no. C2506
PC MK 21-1-3
Heat no. A1113
PC MK 21-1-1
80.66 in
187°
270°
0°
90°
180°