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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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FUKUSHIMA SUBCOMMITTEE

+ + + + +

TUESDAY

OCTOBER 6, 2015

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ROCKVILLE, MARYLAND

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

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COMMITTEE MEMBERS:

STEPHEN P. SCHULTZ, Subcommittee Chairman

JOHN W. STETKAR, ACRS Chairman

DENNIS C. BLEY, ACRS Vice-Chairman

RONALD G. BALLINGER, Member

CHARLES H. BROWN, JR. Member

DANA A. POWERS, Member

PETER C. RICCARDELLA, Member

GORDON R. SKILLMAN, Member

ACRS CONSULTANT:

WILLIAM SHACK

DESIGNATED FEDERAL OFFICIAL:

KATHY D. WEAVER

ALSO PRESENT:

EDWIN M. HACKETT, Executive Director, ACRS

DENNIS ANDRUKAT, NRO

JEREMY BOWEN, NRR

ERIC BOWMAN, NRR

GREGORY BOWMAN, NRR

MICHAEL CASE, RES

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JOHN LEHNER, Brookhaven

PATRICIA MILLIGAN, NSIR

WILLIAM RECKLEY, NRR

TIMOTHY REED, NRR

SELIM SANCAKTAR, RES

JOSEPH SEBROWSKY, NRR

RUSS SYDNOR, RES

MILTON VALENTIN, NRR

ROBERT VETTORI, NRO

*Present via telephone

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P R O C E E D I N G S

8:31 a.m.

SUBCOMMITTEE CHAIR SCHULTZ: This meeting will now come to order. This is a meeting of the Advisory Committee on Reactor Safeguards, Subcommittee on Fukushima.

I'm Steve Schultz, Chairman of the Subcommittee. Members in attendance today Pete Riccardella, Dick Skillman, Dana Powers, John Stetkar, Dennis Bley, Ron Ballinger, Charlie Brown. Dr. Bill Shack is our consultant at this meeting. Dr. Shack is a former ACRS Chairman.

The purpose of today's meeting is to review and discuss the NRC staff's closure plans for the Open Tier 2 and 3 Near Term Task Force Recommendations. The NRC staff's closure plans that we will be discussing today will be the subject of an NRC staff COMSECY paper and the upcoming November 17, 2015 NRC Commission meeting. Today we will hear presentations by the NRC staff

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and by representatives from the Nuclear Energy Institute and the industry regarding their evaluations and conclusions on these matters.

This meeting is open to the public. The meeting is being conducted in accordance with the provisions of the Federal Advisory Committee Act. Rules for the conduct of and participation in this meeting have been published in the Federal Register as part of the notice for this meeting.

The Subcommittee intends to gather information, analyze relevant issues and facts and formulate proposed positions and actions as appropriate for deliberation by the full Committee. Ms. Kathy Weaver is the Designated Federal Official for this meeting.

A transcript of this meeting is being kept and will be made available as stated in the Federal Register notice. Therefore, we request that participants in the meeting use the microphones located throughout the meeting room when addressing the Subcommittee. All participants should first identify themselves and speak with sufficient clarity and volume so that they may be readily heard.

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We've received no written comments or requests for time to make oral statements from members of the public regarding today's hearing. I understand that there are individuals on the bridge line today who are listening in on today's proceeding. To effectively coordinate their participation in the meeting, we will be placing the incoming bridge line on mute so that those individuals may listen in.

At the appropriate time later in the meeting, we'll have an opportunity for public comment from both the bridge line and from members of the public in attendance in the meeting room.

I'd like everyone in the meeting room to please place their phones on mute and your electronic devices not to interrupt the meeting.

I will also note as I already have demonstrated that we all have microphones at the table here that need to be turned on and off when speaking. We do this in order to prevent feedback on the bridge line and so people on the bridge line can hear us and not hear us rattling papers. If you please when you're going to speak turn on your microphone and when you have finished speaking turn

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it off.

We'll now proceed with the meeting. I'll call on Greg Bowman of the Office of Nuclear Reactor Regulation Japan Lessons-Learned Division to open the presentations today. Greg.

MR. BOWMAN: Thank you, Steve.

MR. BOWMAN: I would like to start off with introductions. I'm Greg Bowman. As Steve mentioned, I'm the Branch Chief of the Policy and Support Branch, the Japan Lessons-Learned Division.

This is Milton Valentin. He is one of my project managers. He's been the lead project manager for developing the paper that we're planning to send to the Commission at the end of October.

To my right is John Lehner. He's from Brookhaven National Labs.

And then Selim Sancaktar with the Division of Risk Analysis and Research.

SUBCOMMITTEE CHAIR SCHULTZ: And, Greg, when each of you speak and begin your presentations if you could provide a few remarks on your background and why you're here presenting this information today. It will help the Committee.

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MR. BOWMAN: Of course.

SUBCOMMITTEE CHAIR SCHULTZ: Thank you.

MR. BOWMAN: So our plan for today is to provide you with some background on why we're here, a summary of our plan for each recommendation and then our next steps. Then we'll also provide at the very end of the briefing some information on ongoing research activities into severe accidents that we'll be continuing for a number of years beyond the Tier 2 and Tier 3 recommendations themselves. Next slide.

There are about 15 individual recommendations that we need to discuss today. I'm going to go through the background slides fairly quickly unless there are questions. This slide provides the criteria we used a number of years ago to tier the recommendations.

Largely, the Tier 2 and Tier 3 recommendations are those that required longer term study or there weren't critical skill sets available to work on them or where they were just relatively lower priority compared to the Tier 1 recommendations.

So we did the tiering a number of years

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ago. At the same time, we also provided project plans for each of the Tier 2 and Tier 3 recommendations to the Commission. That was in SECY-12-0095.

Most of the Tier 2 recommendations and some of the Tier 3 recommendations are being addressed by the mitigation of beyond design basis events rulemaking. And in addition we did close one Tier 3 recommendation. That's the evaluation of the need to expedite transfer of spent fuel to dry storage. That was closed last year.

We'll discuss this more with each recommendation. But we have been making progress on those recommendations consistent with the initial plans that we sent to the Commission. For some though we really haven't done much work. We hadn't done much work until our recent initial based largely on the fact that we were focused on the Tier 1 recommendations.

Earlier this year, we began an initiative to look for ways of addressing the open Tier 2 and 3 recommendations earlier than we had originally planned in the SECY paper that we provided a couple of years ago. And then

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subsequently as Steve mentioned we were directed by the Commission to provide them with a paper by the end of October this year with those plans. That's where we are today.

MEMBER BLEY: Greg.

MR. BOWMAN: Yes, sir.

MEMBER BLEY: It seems to me what I've been hearing is there seems to have been, and not today, a drifting away from the origin of Tier 2 and Tier 3 much as you described and mostly availability of skills and dependence on Tier 1 issues and long term study for the other. There seems to be a smell, a sound, coming around that these were really lower priority items.

I don't think that was true initially. Are you going to talk about that as you go through the items?

MR. BOWMAN: Yes, we will. I think that's true. I think at the time that we tiered these we didn't recognize where these fit. So it was probably a mix of we recognized that the Tier 1 recommendations were the highest priority. I think that was clear in the paper we sent up. Those were the highest priority.

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MEMBER BLEY: And could be done in short.

MR. BOWMAN: And could be done in the short term. For some of these Tier 2 and Tier 3 activities as things have developed over the last few years, we've got a better understanding of where the safety enhancements that go along with them would fit in terms of where they fit relative to the quantitative health objectives, things like that.

Our thinking has evolved over the years. I think that's an accurate statement.

The next slide, for each of the recommendations we formed working groups from across the offices at the NRC to develop resolution plans for each of the recommendations. The majority of the Tier 2 and Tier 3 recommendations, not all of them but the majority, are assessments rather than a recommendation to take a specific action.

So for example in Tier 1, there's a recommendation to install severe accident capable hardened vents on Mark 1 and Mark 2 containments. The analogous tier through recommendation would be

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assess the need to install vents on other containment designs.

In completing our assessments, we strove for efficiency by, for example, leveraging the analyses we'd done as part of the two Fukushima rulemakings. We also considered evaluations that weren't directly related to the accident like those associated with the SOARCA project, the containment performance improvement projects, those analyses.

And we considered some of the recent Commission decisions related to Fukushima like those related to MBDBE rulemaking and the containment protection and release reduction rulemaking. For all the recommendations, we considered what safety enhancements have been put in place as part of Tier 1, the mitigation of beyond design basis events order being one of the primary considerations.

In general, what we have in the paper we're planning to send to the Commission is sort of GAP analysis where we look at what we have now, what the recommendation entailed and we tried to identify any places where there were gaps and if those gaps could be filled by things that were

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justified under the backfit rule. That's essentially our approach to going after these recommendations.

The next slide, each recommendation sort of fits into one of three groups. We have group one recommendations that we think can be closed now. We in some cases will rely on the fact that we have existing processes available to address future work, for example, future ROP, reactor oversight process enhancements. We have processes for incorporating those into our existing ROP. Some things like that will be in group one.

Group two would be issues where we think we have sufficient information now to recommend disposition path. But we think there is benefit to interacting further with ACRS, with other external stakeholders. And our goal is to complete those recommendations by March of 2016.

Then there are some recommendations I mentioned earlier where we really had not done any work up until this recent initiative. So for some those, we're calling those group three recommendations which are recommendations that we need some additional evaluation, additional

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assessment, additional development before we're ready to come up to the provide the Commission with our disposition path. Those are goals to complete before the end of the 2016.

In the paper we're sending up in October, we are trying to give the Commission as much information as we can even on the groups two and three recommendations, such that if they want to weigh in this will be their opportunity to do that. We'll give them like for the group two recommendations our initial technical assessment in that paper.

SUBCOMMITTEE CHAIR SCHULTZ: Greg, there's not a lot of time between the time you publish group one recommendations and group two recommendations. And yet you've identified interactions with ACRS and external stakeholders all of that not only to have those interactions but also to have it influence the positions that you're putting forward. Is that enough time for you to accomplish that?

MR. BOWMAN: That's our goal.

SUBCOMMITTEE CHAIR SCHULTZ: Are you going to go through each one by one what is

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scheduled to accomplish that?

MR. BOWMAN: Our goal is to get this done by March 2016. I think we recognize getting on ACRS' calendar is going to be a challenge. There may be challenges that cause us to go beyond March 2016 if need be. But I think we're shooting for that.

SUBCOMMITTEE CHAIR SCHULTZ: I was thinking more in terms of we're all here in the ACRS. We're here to help and support and comment. But I'm more interested in the public interaction. When we say we would like to interact with stakeholders and with the members of the public in these areas that can take time to orchestrate. One needs to define what that interaction is going to be and how it's going to be conducted and completed.

MR. BOWMAN: Right. So for the group two recommendations we do have general milestones for when we would have public interactions and when we think the time we would be ready for an ACRS interaction. That is worked out. I don't believe we have that specifically in the slides, but we have thoughts for how that would go.

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Our thinking is once we get the paper through our steering committee we could have some discussions with you and go through in more detail where we're thinking everything will end up.

SUBCOMMITTEE CHAIR SCHULTZ: To the extent you can speak to that today I'll leave it at that. To the extent that you can speak to that today, I would appreciate it.

MR. BOWMAN: Okay.

SUBCOMMITTEE CHAIR SCHULTZ: And the Committee would appreciate that.

MR. BOWMAN: We can do that as we go through the recommendations.

SUBCOMMITTEE CHAIR SCHULTZ: Thank you.

MEMBER SKILLMAN: Greg, let me ask this please.

MR. BOWMAN: Sure.

MEMBER SKILLMAN: Here was this forest of recommendations from summer of 2011. And we've addressed what we believe to be the most significant in terms of plant safety, core safety, public safety. So it's easy to have the list and say we're working off these last couple ones.

How is the value assessed? So we're

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down to the last couple. And I can imagine if I were in industry saying, AWhat's the value? Why are you even pushing me on this?@ My question is how does the staff describe the value to the NRC and the public and to the industry.

MR. BOWMAN: Yes, I would say it's different for each recommendation. I mean some recommendations we clearly have analysis that were done as part of the rulemakings for example that show us where some of these recommendations would fit relative to the quantitative health objectives.

We can show for some of them that there are orders of magnitude below where the QHO bar is for us to get back to the licensee. There are others where the assessment is more engineering judgment based.

For example, the recommendation on seismically-induced fires and floods, we look at the totality of what regulatory requirements we have in place and what we've done after the accident. Our assessment is that we have enough there that we have adequate protection. We don't need to do anything more.

So each recommendation is sort of

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different. It depends on what supporting information we have. But that's largely it.

MEMBER SKILLMAN: And, Greg, how was that described?

MR. BOWMAN: In the SECY paper, we go through --

MEMBER SKILLMAN: Each one.

MR. BOWMAN: -- each recommendation. Yes, there is an enclosure for each recommendation that provides our basis for why we're coming out where we're coming out.

MEMBER SKILLMAN: Thank you.

MR. BOWMAN: So the next slide goes through where we are now with our binning. We have five recommendations in group one, three in group two and three in group three. And again we'll go through each of these recommendations in more detail as part of the presentation.

We do have very good alignment at the staff level on where the recommendations are grouped and what our resolution plans are. As I just mentioned, the paper is still going through the steering committee. So it is subject to change as we get through the end of October and the paper

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gets to the Commission. But this is where we are now and I think we are in fairly good alignment.

Are there any questions on the overall background? The next slide we'll start moving into the actual recommendations themselves.

MEMBER BLEY: And you're going to go through them even the ones that are proposed to be closed.

MR. BOWMAN: Absolutely, yes.

All right. So slide six, the first recommendation we'll talk about is Recommendation 3. This was a recommendation from the near-term task force to evaluate potential enhancements to prevent and mitigate seismically induced fire and floods in response to insights from the accident.

This recommendation is somewhat unique in that it has a Tier 1 component and a Tier 3 component. Early on the Commission directed the staff as part of addressing this recommendation to initiate development of PRA methodology. Brookhaven had been working on that. And John will talk about that in a minute.

A draft feasibility study for the PRA

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method has been prepared and it's currently under review. So the Tier 3 component of this recommendation would have us use the PRA method to assess whether there's need for additional regulatory action.

With that, I'm going to turn the presentation over Selim and John to discuss where we are with the PRA method and the Tier 1 component.

MR. SANCAKTAR: Thank you. My name is Selim Sancaktar. I work in Office of Research in NRC. I work in PRA area. I would like to give you an overview of what research has done. And then I will let John talk about a little bit more about the details of the study we commissioned Brookhaven to perform on this subject.

We don't have too many slides. We are only between two of us five slides.

When this task was given to us, we had Research initially go through the available material, the information, and passed some judgment on what can be done, what's available. And we collected that in what is termed here -- Can I have the next slide? Thank you -- as Initial Project

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Plan. This is the work we did in Research.

We documented it as a publicly available short report. And to me the more interesting part of it is the attachment where we go through available information. That gives us a glimpse of what is happening and what should be done.

At that time, personally I pretty much had formed an opinion. But to give it due diligence, we commissioned Brookhaven as an honest broker to look into this further to make sure that we had lifted every stone that we could possibly lift and look under.

John will talk about the report that they prepared. First, we started with a more detailed product line prepared with Brookhaven. Basically, the work done by Brookhaven focused on getting the opinions of experts in multiple fields that are related to this particular subject -- this subject involves expertise from different fields -- and getting their view on it, getting other stakeholders' opinions on it and also get opinions from, of course, the NRC, various NRC experts on the subject.

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There was a public workshop held. And this is also documented as a publicly-available document.

And then Brookhaven formed voluntary expert panels on different subjects, sub-subjects let's say, of this and tried to formulate what can be done and how much we can do.

If you look at our project plan, we have a long-term plan including the possibility of a pilot project to implement which by the way we are not recommending it at this point any more. But it was in the original plan.

And then a report was prepared. We passed it around publicly to various experts both inside and outside of the NRC. We put their responses in and the final draft as we speak is send within the NRC for the final feedback so that by December we will close this subject with the issuing of the feasibility report as a public document.

Before I let John continue, let me mention two items because they don't show up here necessarily, although one of them does. They are also pertinent to our conclusions. So I want to

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call attention to two items.

One of them is EPRI has done parallel work in this field. They have produced -- by the way, what I'm saying is not on the slides -- a report with the same title and the abstract of the report is publicly available, but the report itself is proprietary.

And this month, October, EPRI will also I think, if I understand correctly, have a meeting to the start the pilot project in seeing how this subject can be pursued in a graded manner in the PRA.

ACRS CHAIR STETKAR: Selim.

MR. SANCAKTAR: Yes.

ACRS CHAIR STETKAR: Am I understanding you correctly that the industry is pursuing this, but the staff has decided it is not worth pursuing?

MR. SANCAKTAR: It's not a matter of -- Industry is continuing and we are going to --

ACRS CHAIR STETKAR: Well, if industry is continuing, they must see a need for this. So I'm curious why EPRI is developing --

MR. SANCAKTAR: This is a chicken and eggs situation.

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ACRS CHAIR STETKAR: Let me finish my question. I'm curious why EPRI has produced a report and is continuing with this project and even with its implementation perhaps and you and the staff have decided based on nothing quantitative.

MR. SANCAKTAR: Can we wait until I come to my conclusion? I think your question is premature in the sense that I haven't even built my case. I'm giving you input and I'm in slide one of our discussion. If you'll give me a chance, we will address your concern.

ACRS CHAIR STETKAR: Okay, I'll wait.

MR. SANCAKTAR: And hopefully we'll be semi-suspect at least.

ACRS CHAIR STETKAR: I'll wait.

MR. SANCAKTAR: There is work being done to see if EPRI will continue with the pilot project. And in the time frame of 2012, there was work done for the Canadians, Darlington Plant, by a PRA organization in the USA to do a qualitative assessment of seismically-induced fires. We tried to get hold of that report. Although we have detailed information about their method because it was presented in PRA conferences, it was

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proprietary. So we do not have a copy of it.

The second item I want to mention is -- again these two will be used as a basis for our final conclusion -- as we speak PRA standards --

(Off record comments)

-- committees are working on incorporating seismically-induced fires and flood requirements into the current standards. With that information, I will now pass it on to John to tell you about what Brookhaven has done.

MR. LEHNER: Good morning. I'm John Lehner from Brookhaven National Laboratory. We have a risk analysis group there and we were asked to assist NRC in looking at the feasibility of using PRA techniques to estimate the risk from seismically-induced fires and floods.

As Selim pointed out, we held a workshop and then subsequently had quite a number of interactions with people identified at the workshop and others who have been PRA practitioners that have tried to wrestle with this issue of seismically-induced risk for individual plants. Based on our workshop, based on the interactions with these individuals as well as a fairly

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extensive literature search that we did, we've come to the conclusion that at this point a phased or a graded approach for estimating the risk from seismically-induced fires and floods is preferable.

And what we mean by that is rather than trying to quantify the overall seismically-induced fire and flood risk using current PRA techniques, it's more feasible to focus on those scenarios on equipment at a plant that would present the most risk significant fire and flood risk subsequent to an earthquake and doing that using mainly screening techniques.

One would probably start with a plant walkdown that would be targeted at seismically-induced phenomena. In other words, you would be looking at ignition sources and fire sources that you would normally not look at in a fire PRA or flood PRA, things that would become sources as a result of seismic damage.

And then based on that information and other plant information we can start screening plant equipment based on its characteristics, its ruggedness as well as its location and proximity to other equipment, proximity to fire barriers, flood

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barriers, etc. That's the approach that's been used fairly successfully like I said for some individual plants.

We then asked some of our experts if it was feasible to do some generic screening that might simplify this process somewhat. We presented them with a list of ignition sources for instance. And we did get some limited agreement that it may be possible to do this in the case of ignition sources.

But there was general agreement that for internal flooding it's really not screened based on SSCs because you were really interested in the quantity of fluid and the availability of mode of power. That really would have to be a plant specific thing. But I think there was general agreement that one could establish acceptable screening criteria that could be used both for seismically-induced flooding or seismically-induced fire across the family of plants.

ACRS CHAIR STETKAR: John, let me interrupt you there for a second.

MR. LEHNER: Yes.

ACRS CHAIR STETKAR: I'm a bit curious

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about that conclusion given what we've learned about the plant-specific nature of fire risk from the NFP-805 work and other full-scope fire PRAs that have been done over the last 20 years or so. I'm curious how one could do some sort of generic screening for fires, seismically-induced fires or seismically-induced floods for that matter when the risk is so plant-specific because it's based on the routing of particular types of piping in the nature of flooding. And it's also based on the locations of specific fire sources that may be susceptible to seismic damage. If I route a hydrogen line through this room full of cables in this particular plant, my risk would be much different than if I didn't route that hydrogen line through this room.

MR. LEHNER: Yes.

ACRS CHAIR STETKAR: So how can one do that generic screening?

MR. LEHNER: I was not trying to imply that one would do fully generic screening. I mean it's just --

ACRS CHAIR STETKAR: No, but generic screening typically is used as a way of dismissing

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a whole bunch of things generically. So as soon as one says generic screening, one is doing generic screening.

MR. LEHNER: Yes, but I mean you wouldn't stop there. You would obviously --

ACRS CHAIR STETKAR: Then why do you do generic screening if you don't stop? I mean if you're throwing things away generically, for example, seismic damage to hydrogen lines in the auxiliary building generically.

MR. LEHNER: You wouldn't throw that away. I mean the kinds of things that people -- Like I said, there was limited agreement. First of all, let me say that what you said about internal flooding, I think everybody agreed on. There is no generic screening process.

ACRS CHAIR STETKAR: Okay. I thought I heard you say there was.

MR. LEHNER: No, there wasn't. There was agreement that you could find acceptable criteria for screening, but not the screening itself. For ignition sources, certain flagged equipment that did not have sufficient voltage, let's say, or actions that took place always in the

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presence of a operator, it would be highly like that if there was a fire occurring somebody would be observing and dousing it.

There was limited agreement that there might be some. What we did was we presented our panel with the ignition sources that are listed in NUREG CR-6850 and basically asked them to look at that if there were certain things that they could eliminate. And there was some agreement on it.

ACRS CHAIR STETKAR: I don't want to hang up on this because we have a lot of material to cover. I just am bothered by this notion of generic screening especially given what we've learned about the plant-specific nature of risk from both internal fires and internal flooding and for that matter seismic events also.

MR. LEHNER: Yes, I think people agree that you would also have to look at your specific plant if that's still held true for it.

MEMBER SKILLMAN: John, I would like to ask this question please.

MR. LEHNER: Yes.

MEMBER SKILLMAN: What interaction in developing your criteria or your data here did you

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have with American Nuclear Insurers?

MR. LEHNER: American Nuclear Insurers. We didn't have any interaction with them.

MEMBER SKILLMAN: For the record, those of us who have spent years at the plants know that sometimes the more thorough inspection is the ANI because their focus is commercial liability. And they look at oil field transformers. They look at ignition sources. They look at tanks, tank locations, proximity to other tanks, proximity to key buses and their data is extraordinarily good.

So I would just offer from this man's point of view that that is a data source that is worth mining. Every plant has an insurance policy. And that insurance policy is based on how the insurers perceive the risk and the rate is based on indemnification for that risk.

But those inspections are very, very intense and the bidding is very important because if ANI finds that the plant is truly risky, then the fee is very, very high. So there's great incentive for the owners to decrease that risk. That information would really be what you are probably looking for in depth on slide eight.

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MR. LEHNER: You're certainly right that things like oil field transformers for instance, things that you would not normally consider to be a fire source. But if they got damaged in an earthquake --

MEMBER SKILLMAN: Seismically-induced.

MR. LEHNER: Yes.

MEMBER SKILLMAN: And all of us have seen the images of the events a couple years before Fukushima of the overtopping transformers lighting themselves on fire.

MR. LEHNER: It certainly sounds like the PRA analysts should be looking at that kind of thing.

MEMBER SKILLMAN: But I'm suggesting there's information available to you also. Thank you.

MR. LEHNER: All right. I also wanted to mention that the discussions were about also being able to -- those things that do not screen out, they're limited to specific isolated scenarios that perhaps you could use in existing seismic PRA or an existing fire or flood PRA to investigate a particular scenario further and get a better

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feeling for the risk.

There were a lot of suggestions that came from this workshop, the group of people that we consulted, as to how one could enhance this methodology further.

MEMBER BLEY: John, I want to follow up on what John Stetkar was asking. Is what you're putting together going to be guidance on how to do plant-specific screening? Is that the generic part? Or are you actually having some generic screening? Once it's screened, nobody's going to back and look at it again. I haven't seen the details. That's why I'm asking.

MR. LEHNER: Right. I think the larger item is trying to put together guidance for screening both seismically a flood and seismic ignition sources, putting together a screening that could be used as guidance to screen your plant.

In order to facilitate that, we threw out the question would there be some generic screening possible up front. And as I said, there was some limited agreement. I mean out of all those sources there may have been I think less than a dozen that people agreed on that you might be

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able to just confirm that this is not a risk for your plant.

MEMBER BLEY: But if it's phrased that way, that puts the onus back on looking.

MR. LEHNER: It certainly would.

MEMBER BLEY: And that's where we're concerned.

ACRS CHAIR STETKAR: The difference, you say it's a minor point, but I've wrestled with this quite a bit. If the NRC concludes generically that a particular type of scenario can be screened out, as Dennis said it will be screened out regardless of whether you think it's minor or not.

It might be minor at a number of plants and it might not at the couple of plants where it could be a real problem. I agree with Dennis. I'm glad you clarified it because providing guidance for how to do screening is much different than writing a report. That says these particular types of seismically-induced fire or flooding scenarios can generically be screened out because we've got a bunch of people together in a meeting and they all seem to agree on that day and time that seemed to make sense.

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MR. LEHNER: Yes. And I should say that this process hasn't moved along very far. I mean the people that there was limited agreement on still made different assumptions about things.

So you would need to have a meeting of the minds again to iron that out. But certainly the idea has always been that the guidance would say you have to confirm that for your plant this is the case.

ACRS CHAIR STETKAR: The biggest problem by the way that people tend not to think about -- and in the work I've done I haven't solved this problem -- is, for example in seismic, not the low acceleration, high occurrence rate events that you argue there's very little damage to any equipment. Nor is it the very high acceleration events where a lot of things are damaged. And you say it doesn't make any difference whether it burned up or was flooded because it was physically damaged anyway.

It's that medium ground, that medium acceleration ground, that people don't think about very much that doesn't physically damage equipment but results in enough acceleration to seismically-

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qualified equipment, being short circuits within electrical equipment, or for not Class 1 seismic piping systems like fire protection or potable water supplies. It can break those and then can result in flooding.

Or hydrogen lines are the ones I use for fires. They are typically not safety related. And they're routed in places where people decided to route them when they built the plant. So it's that medium ground.

And then when you get experts together they tend to think about these very, very high seismic events because those are the ones traditionally that have shown up as risk contributors from only seismic.

MR. LEHNER: We did have the realization in our discussions here that it's an important question. What size earthquakes do you focus on? Because if the earthquake is too large, than there's so much damage that you really don't care what happens. And as you said if it's small enough -- So then what's the right range to focus on?

ACRS CHAIR STETKAR: It's that medium

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acceleration, medium occurrence rate earthquakes that don't necessarily physically damage, probably very little structural damage and perhaps some moderate equipment damage in the plant, but that may be exacerbated by seismic-induced failures of -- they can ignore what's going on -- seismically-induced fires or floods that could indeed result in increased damage beyond that which would be evaluated by simply the seismic damage or any consequential hardware failures that are typically modeled.

In my experience, those are the things that people when you get them together in a room don't necessarily think about because they immediately think about the very high seismic events. Some of the things that you were talking about as well, the seismic damage will overwhelm the fire damage anyway.

MR. LEHNER: Yes.

ACRS CHAIR STETKAR: And I think that was the genesis of the initial recommendation, the appreciation of a gap if you will.

MR. LEHNER: And that you have to examine forces that you would not ordinarily look

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for.

ACRS CHAIR STETKAR: That's right. Seismic people don't look for it. Fire people don't look for it obviously.

MR. LEHNER: Right.

ACRS CHAIR STETKAR: Nobody looks for it.

MR. LEHNER: I would like to suggest that we go to the next slide.

MEMBER BLEY: We'll get there in a minute. But while you're waiting I had a question that goes back to the discussion John and Selim had earlier. If I'm understanding where you're headed, the staff is still concerned about this issue. You're hoping that what EPRI's putting together will be something you can sign up to to continue this on. Is that where you're headed? Did I misread?

MR. BOWMAN: I think I can answer. So with respect to the Tier 3 piece of this recommendation which is really what we're talking about. We're talking about assessing whether we need to do something more for seismically-induced floods.

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MEMBER BLEY: Right.

MR. BOWMAN: The Tier 3 part of this recommendation and I'll get to this on the slide at the end. Our assessment is that given what we have under our existing regulatory structure we don't need to take additional regulatory action to strengthen the ability of licensees to mitigate seismically-induced fires and floods. We don't see the need based on what we have today. So the answer to that question is no. We don't think we need this PRA method in order to do that assessment.

MEMBER BLEY: You don't need what EPRI is doing.

MR. BOWMAN: No, we don't think so.

MEMBER BLEY: Okay. We see the rest.

ACRS CHAIR STETKAR: We'll wait until we get to the end to ask questions. I will anyway.

MR. BOWMAN: We can talk more about it.

MEMBER BLEY: Do you want to get to the next slide?

MR. LEHNER: So let's go to the next slide.

MR. BOWMAN: So you're on slide?

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MR. LEHNER: Ten. Let's move to 10.
No, sorry.

MR. BOWMAN: Nine.

MR. LEHNER: Yes, nine. So why don't we recommend that one uses current techniques for evaluating the risk from seismically-induced fire and floods? And the agreements, many people agreed that there were too many technical challenges at the moment that would require considerable work to really make this feasible.

Some of them I've listed here. Certainly, trying to model and quantify the risk from multiple concurrent hazards is one of them. Another biggie is the lack of fragility data for seismically-induced fires and floods.

I mean we have fragility data that relates the failure of a component to carry out its function to a seismic parameter like peak ground acceleration. But we don't have any data on what relates to probability of a component becoming an ignition source to the magnitude of a certain ground acceleration. And the same thing is true for --

MEMBER BLEY: When you say that, I mean

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most places for fragility we rely on analysis. That's where most of that has come from.

But for some of these transformer fires, there have been enough of those that you might even be able to rely on historical record. Did anybody look at that?

MR. LEHNER: To get a frequency of that?

MEMBER BLEY: Yes. There have been lots of earthquakes and lots of them with fires. There might be enough information there. I don't know if anybody has ever looked. The old EQE that's evolved into something else now is still reporting on very earthquake with pictures seeing the fires and everything that's going on. So there is about 20 or more years of that.

ACRS CHAIR STETKAR: One would think that's possible for things like transformers, electrical switch gear because they --

MEMBER BLEY: Because they have them.

ACRS CHAIR STETKAR: So there's countable numbers of events even if it's only one. Also we do have fragility for piping systems. So seismically-induced floods, for example,

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seismically-induced fires due to -- I come back to hydrogen because hydrogen pretty much will ignite if it's released into an area. We do have fragility data for piping systems and hydrogen is piped through piping systems. So one could, knowing where the hydrogen is routed, handle that issue I would think.

MR. LEHNER: Yes. There was a general agreement that actually it would be somewhat easier for flooding sources.

ACRS CHAIR STETKAR: Flooding is actually easy. It actually is easy.

MR. LEHNER: Yes.

ACRS CHAIR STETKAR: I hate to keep saying this I, I, I. But in at least four risk assessments that I've worked on overseas, not in the U.S., we've explicitly evaluated seismically-induced flooding looking at the things that you mentioned that you look for internal flooding, but failing the piping systems. That's actually pretty easy because you know where the pipe is and you know the water goes downhill.

MR. LEHNER: Right.

ACRS CHAIR STETKAR: So that's actually

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pretty easy. Seismically-induced fires is a much more difficult issue.

MR. LEHNER: These issues are not tractable. I'm not trying to imply that. It's just that there would be a considerable additional effort involved to get the data. I mean you could do shake table tests on fully energized components and try to ascertain the data.

MEMBER BLEY: Indeed. We've done it for a long time.

MR. LEHNER: Maybe it's only limited to --

MR. SANCAKTAR: By the way, there is an EPRI report 2010 time frame that looked at industrial seismically-induced fires. It's publicly available. They looked at I think 108 events and I have the report.

ACRS CHAIR STETKAR: Can we get -- We don't need it now, but can you make sure you get that report number to Kathy so that we can get a copy of it?

MR. SANCAKTAR: My pleasure.

ACRS CHAIR STETKAR: Thank you. What year was that?

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MR. SANCAKTAR: I think it's 2010.

ACRS CHAIR STETKAR: So that's pretty recent. Get the number to Kathy so we can get a copy of that.

MR. SANCAKTAR: Okay.

ACRS CHAIR STETKAR: Thank you.

MR. LEHNER: Just going down this list, another one is human reliability analysis. I mean there would have to be some enhancements made there to account for what the operators would do in addressing concurrent events, how the added stress of a seismic event affect on shaping factors. There may be lack of access to certain areas of the plant. There may be a lack of help from outside sources like fire brigades for instance. That's also a challenging area.

And then just the last one here, understanding the mechanisms of failure. It kind of relates back to the fragility data. I mean how does a component catch fire?

For instance, there have been some observations, at least two cases, of what they call high energy arcing faults. How does that actually work? It's not really clearly understood. Also

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for flooding if you have a damaged tank, what kind of flow rate do you assign and how much fluid is involved?

So those are some of the areas that would have to be worked on in order to make the state of the art more complete.

I also wanted to mention and Selim alluded to this earlier that as we were carrying out this effort we realized that other organization, particularly EPRI, are also involved in finding approaches to this. In general, those approaches seem to be similar to what our feasibility study is concluding.

It wasn't very surprising because there's a limited family of practitioners here and some of the people that we've talked to are intermingled with the people that are doing this work for EPRI, etc. So the approaches that we've seen are similar. We can go to slide 10.

What's the bottom line here? The bottom line is that the general feeling is that right now carrying out a PRA for seismically-induced fire and flood risk would not lead to really very satisfying results.

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In other words, the technical challenges are still such that that's really not an option at the moment. The results you get would have such large uncertainty attached to them that probably the level of confidence that you could have in those results would in no way be comparable to other PRA results.

MEMBER BLEY: John, you might really delete that, but I sure don't. We've been touches the edges of this for so long. I can see that the first thing one ought to do is what you're talking about and that's plant specific. We need to find the vulnerabilities. But I don't believe that.

ACRS CHAIR STETKAR: And I wholeheartedly concur with Dennis. We have tackled many issues in risk assessment over the last 35 years that are very, very difficult and have very large uncertainties. This is just another one.

I don't know why we give up on it because it's very difficult and has very large uncertainties. If there are plants that are vulnerable to this, we ought to find them before the events happen.

MR. LEHNER: Yes. Nobody is saying

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these problems are intractable. It's just that there's a question.

ACRS CHAIR STETKAR: But the NRC giving up on it, resolving it, checking off the boxes, we're done with this says that. It says it's too difficult to solve, so we're closing the book on it, doesn't it?

MR. BOWEN: Yes, if I could. This is Jeremy Bowen. I'm the Associate Director for the Japan Lessons-Learned Division.

I think the discussion that we're really focusing on to this point has been the Tier 1 portion to consider the feasibility of the PRA and everything. That's what John and Selim have been talking about.

But really the purpose of that activity was to inform and influence what would need to be done for the Tier 3 activity, in other words, to determine whether additional regulatory actions needed to address the seismically-induced fires and floods.

And Greg alluded to it earlier. And I think he's got a slide later. But in the end for the portion that's being discussed here, whether or

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not a PRA is available or not, it really doesn't determine. It's influences the Tier 3 activity, but the conclusion with the Tier 3 activity is that because of the other lessons that have been learned and implemented in the Tier 1 activity, the improvements that have been put in place because of all that when you factor that in, any additional information isn't really necessarily needed to inform and conclude that no further regulatory actions are needed in the Tier 3 activity.

I think that this is an important and valuable discussion. I think there is some discussion from Research later about the ongoing research work that we'll always continue. But the piece here is the tie to the Tier 3 activity.

ACRS CHAIR STETKAR: Just to make sure I understand the conclusion then. You've concluded that the potential safety benefits from pursuing this do not justify pursuing it. Is that correct?

MR. BOWEN: That's correct.

ACRS CHAIR STETKAR: Okay. I'd like to really, really understand how you made that conclusion. The Tier 1 work that's been put in place only addresses seismic events up to the

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plant's design basis. It does not address event survival of in-plant equipment beyond the design basis seismic acceleration. And it certainly doesn't address any of these issues about seismic-induced fires as a contribution to risk.

I'm really curious how you can make the conclusion for the entire U.S. nuclear industry that the safety benefits of pursuing this are not justified by the effort.

MR. BOWEN: We are doing --

ACRS CHAIR STETKAR: For every plant. Every operating plant out there.

MR. BOWEN: We are doing work as part of the seismic reevaluation and looking at things beyond the design basis. That is part of the mitigation of the beyond design basis event rulemaking.

ACRS CHAIR STETKAR: Only all of that equipment must only survive up to -- It must be robust. I don't know what that means because it hasn't been defined. We've been looking at draft regulatory guides and NEI documents to try to understand that. But nobody seems to be able to tell what that means.

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But I know that people are just saying it's qualified up to the design basis. And people are arguing about what does design basis mean in a legal sense now after the reevaluated seismic hazards. But it's kind of around where it's currently qualified to. For example, if the design basis earthquake is 0.15G it's not supposed to survive 0.3G.

MR. BOWEN: Actually the draft rule language for the mitigating beyond design basis event rulemaking does have language in there that says that the mitigating strategies must be able to survive to reevaluate its seismic hazard.

ACRS CHAIR STETKAR: Okay. Reevaluate it. If the reevaluated seismic hazard is 0.15G it need not survive at 0.3G.

MR. BOWEN: That's correct.

ACRS CHAIR STETKAR: And I use that very carefully because there are words in there about 1.67. So I use 2.0.

MR. BOWMAN: If there is an earthquake that --

MR. BOWEN: If there is an earthquake that's not applicable to the plant, then it's not

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considered a feasible occurrence.

ACRS CHAIR STETKAR: But in risk assessment we're talking about, I see these words PRA throughout here. We've used PRA to conclude that the risk to the plant does not justify somehow pursuing this.

MR. BOWEN: From a regulatory standpoint, that's correct. We do not believe that there's sufficient justification to pursue or proceed with the additional regulatory action.

ACRS CHAIR STETKAR: Okay.

MEMBER BALLINGER: So again I agree with John and Dennis. But are you saying that the likelihood of you finding a particular plant that has an inordinate risk is so low if you went through at least the first step of this that it's not worth doing?

MR. BOWMAN: So when we did the assessment of the Tier 3 component of the recommendation, we looked at things like the fact that the licensees have very robust fire protection programs, flood protection programs. We looked at the fact -- If you go back to the walkdowns we did after the Fukushima accident, on a plant specific

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basis we looked for vulnerabilities in the area of seismically-induced fires and floods. That was one of the things the licensees looked as part of their walkdowns. And corrective actions were taken when things were identified.

Yet the assessment we provided in the SECY paper has a whole list of reasons why we don't think --

MR. BOWEN: Probably help if you went to slide 12.

ACRS CHAIR STETKAR: I noticed those walkdowns in the enclosure. Do you have any other examples? Things that I found is that most fire protection, detection and protection suppression systems are not seismically qualified. They are nonsafety related. They're in standard industrial cabinets and things like that that again have typically fairly low fragilities.

When you talk about robust fire protection programs, those fire protection programs are designed for fires. They're not designed for seismic events because the designers haven't had or haven't been required to think about their survivability during a seismic event.

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MR. BOWMAN: So there are provisions and we can get you examples of things that were found.

ACRS CHAIR STETKAR: That would be helpful because the walkdowns were mentioned a couple of times.

MR. BOWMAN: Right. And we can get you examples. The guidance for design, I'm not an expert in this area if there are anyone in the room who wants to help. The fire protection equipment while it's not seismically clean besides the Category 1 equipment, it is designed to be resilient to seismic events. That's specifically discussed in the regulatory guide for fire protection programs.

DR. SHACK: It says it should consider.

MR. BOWMAN: Right. So it's not -- I agree it's not Category 1 equipment. So another thing we talk about in our assessment is the fact that if you look at operating experience, we've had some earthquakes that have exceeded the design basis of the facilities, the KK earthquake, the Onagawa. The Onagawa was impacted.

ACRS CHAIR STETKAR: Okay. The KK had

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a fire.

MR. BOWMAN: That's right. A fire nonsafety related component that was put out relatively quickly.

ACRS CHAIR STETKAR: Good for them.

MR. BOWMAN: Onagawa, the same type of thing. They had a seismically-induced fire, but it was put out without any impact to public health and safety. North Anna had an earthquake that exceeded their SSE.

ACRS CHAIR STETKAR: Not by much.

MR. BOWMAN: There was no impact at all to any -- There was no functional impact to any equipment at the plant.

ACRS CHAIR STETKAR: And again I'm not talking about small exceedents. I'm talking about this moderate occurrence rate what I call in terms of seismic damage moderate acceleration. So it's something like two or so of the design basis earthquake acceleration, not three or four where you start to see real high conditional probabilities for equipment failures and piping and things like that.

MR. BOWMAN: Yes, I understand. I

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think we have -- I don't think you could point to anyone of the things on this slide and say that in and of itself will lead us not to take any action. But I think when you look at the totality of all the things that we have in place to protect against fires and floods we don't see that there's a substantial safety benefit to imposing new requirements on our licensees. I think that's the bottom line based on our assessment.

And because the Tier 3 assessment that we did on this slide found that, we don't think the significant resource expenditures to finishing the PRA method makes sense given where we are with project aim and with our budget. That's where we're coming out on this recommendation.

MR. LEHNER: I would just like to add that the study did not touch on those aspects of it. We basically looked at what's the most reasonable way to proceed at this time and we felt that this graded approach was the way to go. But we did not make any judgment as to what to do with that. The NRC has all the reasons for how to handle that.

SUBCOMMITTEE CHAIR SCHULTZ: John, you

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didn't finish slide 10. Could you go back to the second bullet? I think it's the second one on slide 10.

MR. BOWMAN: This was supposed to be the easy recommendation. That's why we started with it.

(Laughter)

MR. LEHNER: So what I wanted to say was that currently the PRA treatment didn't seem reasonable without quite a bit of additional work. But there is pretty much an agreement in the PRA community that a phased, graded approach would be the way to go and the way that I've briefly outlined. You could apply this to a pilot application and see how far you can drive that approach and also learn where you'd have to develop new methods and what you would have to do to eliminate some of the things that you can't screen out. That's basically the bottom line.

SUBCOMMITTEE CHAIR SCHULTZ: How is the NRC staff intending to follow this work? Is that a way that the NRC staff is going to go in concert with EPRI or following with EPRI? I'm not understanding that piece.

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MR. SANCAKTAR: At this point, we do not have any specific plans.

SUBCOMMITTEE CHAIR SCHULTZ: Are you recommending any plans to be developed given that EPRI is moving forward with this approach from what we've seen?

MR. BOWMAN: I think we can take that back.

MR. SANCAKTAR: The subject kind of got blurry. We didn't reach our slide 11 which would have been our conclusion. But we pretty much discussed everything.

The argument here is -- By the way, we are not making this -- I'm talking from a PRA point of view. I'm not talking about the policy or anything, just PRA practitioners. Of course, as a PRA practitioner, I'm interested in doing PRAs. This is our bread and butter.

When we say that in this case I strongly believe that we reached a point that NRC by continuing to invest more effort into this in a PRA sense -- PRA to me means risk assessment quantification -- is not productive. However, PRA never claims that something ends. We are

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constantly surprised by emergence of new information and issues. So we always follow them.

NRC has many paths to follow what's happening in the industry. We will continue to follow as far as I'm concerned and act accordingly. First, we have to observe what the EPRI process will result in. We don't have to duplicate it at this time. And we have to make sure that the standards are supplemented to the inspection of the NRC and let this takes its course and monitor it and interject as needed.

MR. BOWMAN: I think I heard you say just in response to Steve's question. We will stay tied in with what EPRI is doing. It's not like they'll be off doing their thing and we'll be blind to what they're doing.

MR. SANCAKTAR: Right.

MR. BOWMAN: Is that an accurate statement?

MR. SANCAKTAR: Yes.

MEMBER RICCARDELLA: This second bullet, is that the essence of what EPRI is doing?

MR. SANCAKTAR: Yes.

MEMBER RICCARDELLA: That's the essence

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of what EPRI is doing.

MR. SANCAKTAR: Start with a qualitative approach to see how you can.

MEMBER RICCARDELLA: And you're putting a pilot in.

MR. SANCAKTAR: Say it again.

ACRS CHAIR STETKAR: Because the EPRI -
- You said the EPRI report has been finished, but it's not publicly available.

MR. SANCAKTAR: Right.

ACRS CHAIR STETKAR: So we at ACRS have difficulty getting access to those things. I'd be really interested to see it if we could get it somehow. But we'll have to work on that.

The enclosure though does -- Enclosure 3 to the draft SECY paper -- does mention what I think John and you have been talking about is this feasibility study that Brookhaven has been working on. And it mentions that a report from that study is supposed to be available by the end of this year.

It shows like you're going to accept that report. And that's basically the end of the funding for Brookhaven in this area. I think not

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in the context now of Fukushima Tier 2, Tier 3 activities in a regulatory sense but certainly in the context of PRA we would be really interested in seeing that. It is an issue that I don't know generically what the risk is from seismically-induced fire and flooding.

I don't know whether particular plants might have vulnerabilities to that. It's just a suspicion given plants that were looked at is they might. But I'd really be interested to see it. Brookhaven has obviously put some work into this. If they have a report available by the end of the year, I think we'd be interested in seeing that when it's done.

MR. SANCAKTAR: Actually, at this time, if you look at slide seven, it talks about draft feasibility report.

MR. BOWMAN: We're going backwards now, Selim.

(Laughter)

MR. SANCAKTAR: Yes, we're having so much fun that.

MEMBER SKILLMAN: But that's a draft.

MR. SANCAKTAR: But in essence it's not

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going to be any different.

MR. BOWMAN: We can share the draft with you because it is available.

ACRS CHAIR STETKAR: Yes. You have the ML number for the draft.

(Simultaneous speaking)

MR. BOWMAN: We'll make sure you get the final version of the report.

ACRS CHAIR STETKAR: That would be good.

MR. BOWEN: If I could, Dr. Stetkar, I appreciate the comment he just made, too. And it actually might help clarify some of the comments I was trying to make earlier from the standpoint of these recommendations. We looked at it from should any action be taken under the umbrella of post Fukushima, not necessarily prohibiting any further normal agency processes from continuing as they would absent the accident. We're looking from the standpoint of should an action be taken under the umbrella of a post Fukushima sense.

ACRS CHAIR STETKAR: Okay. But be careful because without the incentive from the Fukushima Tier 2, Tier 3 recommendations it sounds

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to me like the agency is basically saying we're not going to follow through on this. We'll keep an eye on what EPRI may or may not be doing. But we're not going to invest any more money in pursuing a methodology or thinking about how it might be applied in a pilot application under NRC funding. Quite honestly given the practicalities of current resources, this may be vulnerable to dying a very rapid death without being under the Tier 2, Tier 3 recommendations.

I wanted to separate in my comment the notion of pursuing this from understanding how Brookhaven because we haven't seen the EPRI stuff has addressed the problem, has characterized the problem. There are a lot of words in the enclosure about difficulties and technical issues and things like that. Then we could understand from a technical basis what those issues are what the current thinking is.

You've raised the notion from a regulatory perspective in terms of backfitting considerations and things that the staff has concluded that the potential safety benefit from pursuing this cannot be justified. That's your

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decision.

I don't necessarily agree with that. And I'm saying that without that Tier 2, Tier 3 incentive this may very well die. I just wanted to get that on the record and clarify what I was saying.

DR. SHACK: I just want to go back again to this line AThe NRC expects that NPP is located in areas of high seismic activity and will design their fire protection systems to the function of shake-shutdown earthquake.@ Now an expectation is certainly not a requirement. But do you have any information from the seismic one or the recommendation one PRAs and seismic margin things whether people when they look at the fire protection systems find that they are in fact robust?

MR. BOWMAN: Do you have any more on that? I don't know.

MR. BOWEN: I don't know a comment on that.

ACRS CHAIR STETKAR: The key is they don't look at it.

DR. SHACK: That's the answer then.

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They don't look at them.

MR. BOWMAN: That's John's answer. I'm not sure that's our answer.

ACRS CHAIR STETKAR: Will we ever get - - and we probably won't at ACRS -- a chance to see one of those things? I know to date most people have not.

MEMBER SKILLMAN: I'd like to pursue Dr. Shack's open ended question a little bit further. But I begin with an observation. I think it's fair to say all of the plants today are designed on the basis of the general design criteria. At one time there were 70. There are currently 64 and interpretations of Reg Guide 126 and 129. It is the combination of those three that gives us the plants that we have today.

I'm curious why through all of the Fukushima discussions there hasn't been some consideration for new plants adding fire protection to that list of systems that must be seismic one.

Right now, it's for reactor coolant system pressure boundary, emergency core cooling and cooling systems required for those cooling systems. So that basically gets you all of the

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ECCS component cooling water as it applies to RHR, DH, building spray, building cooling, and some other functions inside the building and throughout the plant.

Why at least for new plants hasn't the agency considered adding fire protection as part of the seismic one systems? And the reason I say that is because it takes part of this risk question off the table if you could say I have a seismic one fire protection system. The dynamics would be different.

Some of the systems that you're hoping will work are automatic. They're sprinklers. And so they're intended to auto-start and auto-quash. A point is that not all firefighting systems are fiber hoses or cotton hoses and your firefighting teams. But it seems for the new plants that would have been a reasonable outcome based on all that was learned. My question is what consideration has been given to that.

MR. BOWMAN: With respect to the new plants that have already been issued licenses, we would still have to go through essentially the backfit process, issue finality provisions, in order to

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impose a backfit like that on a licensee. And the same considerations that apply to the current reactors would prevent us from meeting the backfit, meeting the bar for those plants.

MEMBER SKILLMAN: I understand for currently under construction plants and for currently constructed plants with an operating license. I'm talking about a plant that has not yet been initiated.

MR. BOWMAN: I don't know. We did not -- Again, I think the same factors on the slide we showed before would influence us towards not needing to do more for those. But I don't know that new reactors looked at that specifically as part of their involvement in this recommendation.

MR. BOWEN: I don't think we have. That is correct. We didn't explicitly discuss that during the recommendation. And as far as the broader question, I don't think we have anyone in the room with the appropriate expertise to answer why it wasn't consider more holistically.

MEMBER SKILLMAN: It seems like it ought to be something that is considered given all that we know. Clearly, from all of the information

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that we have on risk, fire is as great a concern as a small break LOCA. Thank you.

MEMBER BLEY: Before you go on, I'd like to thank John Lehner for not pronouncing that dreadful acronym.

(Laughter)

MR. BOWMAN: I hate that one myself as a matter of fact. Thank you.

MEMBER BLEY: It was actually worse, but we won't go into it.

MR. BOWMAN: So we're about an hour behind and one recommendation in. Do you want us to --

SUBCOMMITTEE CHAIR SCHULTZ: Go to slide 12 and resummarize and then go forward.

MR. BOWMAN: So again, this slide really just provides a list of the factors to be considered in determining the Tier 3 recommendations. The Tier 3 component of this can be closed now.

We discussed that the challenges that will be documented in the feasibility study at the end of December in addition to the fact that we don't see a strong basis for imposing the

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requirements for the Tier 3 component. That will lead us to discontinue work on the PRA method. But of course we'll pass that along to you and it will be interesting to get your feedback on that.

MEMBER BLEY: One last question before we leave this one.

MR. BOWMAN: Yes.

MEMBER BLEY: And Selim is probably the one on this. There's a longstanding memo of understanding between EPRI and NRC on fire-related things. Does this work fall under that? Or is this strictly their work and it's not part of that agreement?

MR. SANCAKTAR: I don't know.

MEMBER BLEY: I really wish it were part of that agreement.

MR. BOWMAN: We can get you an answer for that.

MEMBER BLEY: Thank you.

SUBCOMMITTEE CHAIR SCHULTZ: If you can get us an answer to that, I would appreciate that, Greg.

MR. BOWMAN: We will.

SUBCOMMITTEE CHAIR SCHULTZ: The other

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question I had, Selim, is that you mentioned the standards work ongoing. I'm presuming that NRC has representation on the standards committee related to that work.

MR. SANCAKTAR: Yes. In fact, I'm the person in the technical evaluation or whatever.

SUBCOMMITTEE CHAIR SCHULTZ: Good. Thank you.

MR. BOWMAN: I'm going to go to slide 13. So the next two recommendations we're going to discuss are group three recommendations. That means those are recommendations that are not well developed yet. We have a lot of work to do. I'll try to move through these a little quickly recognizing --

MEMBER BLEY: Before you fly on, you had group one and you just did one of them.

MR. BOWMAN: Yes.

MEMBER BLEY: Are you going to go back to any of the others?

MR. BOWMAN: Yes, I'm going to try.

MEMBER BLEY: I'm sorry. I missed that.

MR. BOWMAN: So this is one of the

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group three recommendations. It came from the ACRS and from the 2012 Appropriations Act. It would have us reevaluate external hazards other than seismic and flooding. Up until the current initiative we really had not done much work on this. We were really focused on the Tier 1 hazard reevaluations.

I will mention that in developing the strategies under the mitigating strategies licensees will require to assess a number of external hazards and ensure the mitigating strategies will work under those conditions. And that's a site specific analysis.

I visited a site recently that their mitigating strategies were designed to handle volcanic ash for example. There's a big table in the guidance for mitigating strategies that each of the licensees need to go through those hazards and assess how they impacted their site.

Our initial plan which was put together back in 2012 like I mentioned would have had us issue 50.54 to all licensees to address this recommendation. Go to the next slide please.

As I mentioned, we haven't made much

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progress on this until we started working recently. So we do have it in group three with the goal to close by the end of 2016. We did put together an approach that's documented on this slide for how we might go about assessing other external hazards. We think that an approach like this when we do an internal screening at the NRC first before issuing a 50.54(f) letter if one is needed would add efficiently and effectiveness to the process.

And so we do have some details to work through on how these steps would work. But essentially what they entail is first defining the population of natural hazards that should be looked at. And that's been completed. Then screening those to determine if any can be excluded.

So step three would be like a technical evaluation where we look at things like the nature of the hazard, if it's a slow moving hazard, if the licensees already have measures in place to prevent it from being a safety risk. And then step four would involve us going out to individual licensees with a 50.54(f) letter if necessary for any site specific hazards that aren't screened out as part of one, two and three. That's the general process

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we're working on.

The SECY paper will talk about the four steps on the previous slide. It will talk about essentially that we're planning on working through development of the process more formally and providing the assessment to the Commission at the end of 2016. We expect that ACRS and external stakeholders will certainly be involved in the work-through of that process.

That's external hazards. Any questions on that? I know I went through it quickly.

ACRS CHAIR STETKAR: No question because this one is going to be continued.

MR. BOWMAN: Right.

ACRS CHAIR STETKAR: And we'll have opportunity to have additional discussions on it. One thing that I would caution because I haven't seen obviously anything is there is a tendency to compartmentalize external hazards. One looks at high winds. One looks at flooding. One looks at seismic events.

There is not a tendency to look at what are the effects of severe storms that include high winds, a lot of rain at the same time. Certainly,

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one hopes not a seismic event. Sites that may be affected by intake plugging due to debris that could be generated during a very, very severe storm, whether it's a coastal site or a river site for example.

And that was a bit of the genesis I think of our concerns about looking at other external events, both to look at things like tornado wind damages as you indicated here, but the integrated effects of, for example, very, very severe storms that have a combination of all of those factors that you might not necessarily think about in an integrated fashion if you only look at the winds and only look at the water and only look at things that might affect intake availability. As you start to do that identification of other hazards and the discussion of expected hazards as a primary concern, think about it in that context. When we have the next discussion, you're going to hear the same comments.

MR. BOWMAN: Thanks.

The next slide is another group three recommendation. This is a recommendation from the near term task force. It was recommendation 2.2.

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The initial recommendation would have had the NRC initiate a rulemaking to reconfirm seismic and flooding hazards every ten years. The recommendation was subsequently expanded to include other natural hazards besides seismic and flooding. Again, this is a recommendation we really have not done much work on until recently largely because we've been focused on the Tier 1 seismic and flooding hazard reevaluations. The next slide.

We did evaluate options though as part of our recent initiative for addressing this recommendation. Because of the resources that it would take to do a rulemaking and the likelihood that it would be justified in the backfit rule or not of high enough priority to pursue given the other rulemakings that we're working, we don't think that rulemaking is a viable option for addressing this. But we do think that there are benefits to enhancing existing internal processes to address this recommendation.

While we think the current processes are adequate obviously to ensure adequate protection for the licensee's annual information, we think they could be made more proactive and

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systematic through some adjustments. The details on how we'll make those adjustments haven't been worked out. That's part of what will take place over the next year.

But it will largely be leveraging existing processes, adjust the generic issues program, things like that to ensure we're collaborating on a more routine basis with Federal stakeholders, with licensees, with other organizations to ensure that information is gathered on a more systematic basis. We think that rather than using that option rather than rulemaking would have a number of benefits. We think it would eliminate the burden on the licensees unless we find that new hazard information is significant and could impact them. Again, it would cause us to be more proactive in going out for information. We'd be more consistent on how we treat new hazard information.

So under our current processes, there is the potential that there could be an ad hoc response to new hazard information. This would ensure that we're more consistent going forward in how we treat that information.

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We do think that while there would be resource implications associated with both modifying current processes and then going forward on a reoccurring basis we think if it's done right and it leverages the existing processes then we could be more efficient in the long term. We think it makes sense from that standpoint.

I realize that there's not a lot of concrete detail in what we're actually planning on doing in this. That's because it's a group three recommendations and we just started working on it. So we will -- Go ahead, John.

ACRS CHAIR STETKAR: Finish your last sentence.

MR. BOWMAN: I forgot what I was going to say.

(Laughter)

ACRS CHAIR STETKAR: My intent exactly. When I read through this, I see the direct you're headed. In a note that I scribbled in the margin it said this looks like in my opinion a reasonable approach for things like improved methods, improved evaluations of seismic hazards, you know, USGS, everything that is on the seismic area, improved

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methods for probable maximum precipitation or probable maximum flooding or whatever the heck that stuff is.

What I don't know and one of the concerns is when plants update their FSAR do you they update the information that they use in the original licensing analyses regarding meteorological effects. For example, in many cases, plants use or used something like the five most recent years of weather data to determine peak temperatures, rainfall rates, things like that.

We have a lot more information available. People, for example, today in Columbia, South Carolina are not happy campers because weather events do occur but with countable frequencies.

And one thing that I've seen in Europe in the periodic safety reviews is that people do update that operating experience from the last ten years. The meteorological data, have we had 20 inches of rainfall in three day events over the last ten years that might change our notion about the frequency of a really bad storm? And the sense that I got is that this process might not address

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that type of issue.

MR. BOWMAN: It would not unless as part of the evaluation an issue comes out where we decided we need to backfit a licensee or make them change their FSAR. Under current processes, licensees are not required to update their FSAR based on new hazard information.

ACRS CHAIR STETKAR: Right.

SUBCOMMITTEE CHAIR SCHULTZ: But what would be happening with the staff? You have a bullet, plans to enhance internal programs to more proactively and systematically assess new hazard information?

MR. BOWMAN: This is one that's a group three recommendation. We have not done much.

SUBCOMMITTEE CHAIR SCHULTZ: Okay.

MR. BOWMAN: What it would likely largely entail is going to an existing processes like -- and this is just off the top of my head -- the generic issues program, the operating experience program, looking at ways we can modify those to have them be more proactive.

SUBCOMMITTEE CHAIR SCHULTZ: But we're talking specifically about natural hazards here.

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MR. BOWMAN: Yes.

SUBCOMMITTEE CHAIR SCHULTZ: Not those programs.

MEMBER RICCARDELLA: The seismic update was already underway as part of the generic issues program post Fukushima.

ACRS CHAIR STETKAR: But my point is that -- trying to read between the lines here on something that's admittedly evolving -- this process could capture those large kind of generic, programmatic, nationwide issues like seismic hazard reevaluation or a fundamental change in the methodology for evaluating ground motion response or a fundamental change in the methodology for quantifying probable maximum precipitation or something like that.

It's not clear that it captures evolving knowledge about site specific meteorological effects that could change our understanding of a particular site's vulnerability if I want to use that term as it's changed from whatever snapshot of meteorology which admittedly is very, very small even if they use 30 years of experience. That would be captured by a more

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systematic, periodic reevaluation that indeed over the last ten years, whether it's ten or whatever, we have not seen in our region any severe storms or any additional tornadoes or whatever that would lead us to believe that our original licensing basis assumptions are questioned.

And that's site specific. You could do that on a generic basis, but it's a different concept than this notion of a change in the methodology for seismic hazard reevaluation or a change in the methodology or probably maximum precipitation evaluation.

MR. BOWMAN: Yes. Again, we still have to figure out how we're going to do this.

ACRS CHAIR STETKAR: Yes, this is telegraphing. We'll have more discussion.

MR. BOWMAN: I will say that one of the factors that we thought through is with Generic Issue 199 we were working on that at the time of the accident. But the way that information came to us was because we were doing new reactor reviews and saw differences. So we were essentially reactive in that case. I think one of the goals of this is to be more proactive where we're going out

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and finding that information rather than it coming to us through something like new reactors.

MEMBER RICCARDELLA: I have two kind of related questions. When you do these hazard updates as is being done now and you said that would eventually lead to an update of the USAR.

MR. BOWMAN: Possibly.

MEMBER RICCARDELLA: If there's a new ground response spectrum, does that become the new SSE for the plant?

MR. BOWMAN: No, it does not. Unless we backfit the licensee, that is not their new SSE. The new information, it's incumbent on the NRC when the new information comes to take a regulatory action to backfit.

MEMBER RICCARDELLA: Okay. So it is legitimate for a licensee to say AWell, I've got a new seismic evaluation or a new ground response spectra. I'm going to handle with, for example, my flex equipment@ as opposed to --

MR. BOWMAN: Yes.

MEMBER RICCARDELLA: That is a legitimate approach.

MR. BOWMAN: Yes.

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MEMBER RICCARDELLA: Okay. And then speaking for one of our members who isn't here, he believes that this should be regularly done as part of license renewal. That is if you're going to renew the license shouldn't you take a relook at what your hazard definitions are at that time?

MR. BOWMAN: I'm not an expert on license renewal. But I know our focus is on aging management and this would be outside the scope of that. I think what we're proposing to do for this recommendation would capture that concern in a different way without changing the way we do license renewal.

MEMBER RICCARDELLA: Okay. And you're saying you're periodically updating it anyway. So it will get picked up.

MR. BOWMAN: That's right.

MEMBER RICCARDELLA: Okay.

DR. SHACK: This is another one of those expectations though. I'm looking at the white paper on the third party information where there's an expectation that they will update their FSAR in response to new site safety significant, but it's not a requirement.

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What's the impact of an NRC expectation? Fire protection equipment to be seismically robust. How do you get a warm feeling about this or how do you expect them to update their FSAR?

MR. BOWMAN: I'm not going to be able to answer why we put those words in a reg guide 20 years ago. I mean it is a challenge when we aren't clear in what our requirements are, not our expectations. I guess if we're reviewing a fire protection plan if the expectation is not met we might go back to the licensee and ask AHere's what we're expecting. What are you doing to compensate for the fact that you don't meet this expectation?@

I was an inspector for a number of years and I can tell you that it's challenging when you're an inspector and the words are like expect or.

DR. SHACK: And then I see this other one that says section 50.71(e) already requires the licensee to maintain a current and accurate FSAR. That sounds like require, but we only expect.

ACRS CHAIR STETKAR: That's why I wanted to get an updated FSAR on the record.

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DR. SHACK: But I mean they've gone after this in the white paper in the generic issue and they sort of came up it seems to me chasing this thing around where there's an expectation. Maybe there's a requirement.

The good news is when they did the inspections they didn't find any significant safety concerns they hadn't addressed. But it still seems confusing.

MR. BOWMAN: Okay. I think we're back on schedule now.

(Laughter)

SUBCOMMITTEE CHAIR SCHULTZ: That's why I wanted the next slide. With that, we'll call a break and reassemble at 10:20 a.m. please.

(Whereupon, the above-entitled matter went off the record at 10:04 a.m. and resumed at 10:22 a.m.)

SUBCOMMITTEE CHAIR SCHULTZ: Call the meeting back to session. Greg, I'll turn the program back to you.

MR. BOWMAN: So the next two recommendations we're going to cover are recommendations 5.2 and 6 and I'm going to

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introduce the man who needs no introduction, Bill Reckley, to cover those two recommendations for us.

MR. RECKLEY: I'll just end on that high note. As Greg mentioned, we're going to talk next about recommendation 5.2 which involved an assessment of the containments other than Mark 1 and Mark 2. Mark 1 and Mark 2 were addressed in the Tier 1 issues. We largely set that item aside as we worked on Tier 1 items for the Mark 1s and 2s including the issuance of the order and the containment protection and release production rulemaking which we've talked numerous times to the Subcommittee and the full Committee about.

The current status of that is that we did issue Order EA-13-109 for the Mark 1s and 2s requiring a severe accident capable vent. The Commission recently made its decision on the containment protection release reduction rulemaking that we would not pursue that. The water addition, the biggest component or question was whether the water addition component of the way licensees were complying with Order EA-13-109 would itself be codified or whether it would continue to be handled through the order. And the Commission decided that

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the order was sufficient.

There are many other activities, the mitigating strategies, the mitigating beyond design basis event rulemaking and as I just mentioned the CPRR Commission decision that we take into account as we assess the other containment designs.

ACRS CHAIR STETKAR: Bill, I like the second bullet on this slide. I really stumbled over a lot of the verbiage in this part of the enclosure four and other enclosures by the way because the paper and the enclosures often refer to this notion that the Commission has disapproved things like SAMGs and these things. They've disapproved proceeding with formal rulemaking.

MR. RECKLEY: Right.

ACRS CHAIR STETKAR: They haven't necessarily disapproved of the notion and as I read through this --

MR. RECKLEY: It's just the opposite actually.

ACRS CHAIR STETKAR: Well, in fact, just the opposite. Thanks. I'm glad you said that. As I read through this in many cases the argument seems to be made that because the

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Commission has disapproved of this there's no need to consider peripherally related issues to it. And I just recommend that you read through it from a skeptic's point of view and see whether or not I'm a member of the public I might be misled by the impression that the Commission has simply said that vents are a bad idea or has simply said that SAMGs are a bad idea.

MR. RECKLEY: Right.

ACRS CHAIR STETKAR: The second bullet is correct.

MR. RECKLEY: Okay. That's a good point and we'll take a look. It came up during the first discussion I think and I'll just repeat it here. We're looking primarily to determine whether regulatory action should be made, whether rulemaking should be undertaken, whether orders should be issued to require our licensees to do something that they're not currently doing or to codify something that they're currently doing so that it becomes a regulatory requirement.

When we say in our general discussion we're not going to pursue it, it is not as if we're not going to continue to do advancements to the

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state of the art and PRA methodologies. It's not that we're going to discourage licensees from doing anything they're currently doing in terms of good practices. It's that we're reaching the decision we're not going to take any regulatory action and put it into a regulation, a license or an order.

So the initial assessment -- and I'll go through a little bit of the logic that leads us to this conclusion -- is that there is a significant body of work, TMI and pre-TMI even, related to containment performance improvement program, NUREG 1150, the current SOARCA work both what was completed for Peach Bottom and Surry, what's on going for Sequoyah, the information and more recent analysis from a regulatory perspective that we took for the orders and the CPRR rulemaking, as we just discussed, Commission decisions on what regulatory approaches to take. And we looked at that across for the various containment types.

The conclusion is that there's not a basis for additional regulatory actions for the other containments. And the write-up tries to lay out that that's our conclusion and that absent any

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new information we might get from interactions with the public or the ACRS, that's where we think we are. So that's currently the statements in the paper.

The other issue -- and I combine them because I think it's kind of artificial to separate them but they were two different recommendations, 5.2 and 6 -- Recommendation 6 is on hydrogen control. It's hydrogen control within the containment buildings and in adjacent buildings looking at Fukushima obviously and the explosions in the reactor buildings.

This was also prioritized as Tier 3 as we addressed the Mark 1s and 2s designs. And we are currently assessing that much like we did 5.2 in terms of other containment failure mechanisms. That current status is we've looked at EA-13-109. 13-109 talks about the control of hydrogen for the vent system. It didn't totally address hydrogen issues related to Mark 1s and 2s, but the order does require that the vent system be looked at in terms of the potential -- It requires that you either prevent or address the detonation of hydrogen for the vent system itself.

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Then as the other activity I mentioned, there are ongoing or recent insights from Commission decisions.

MEMBER POWERS: Do we have any significant understanding of the hydrogen combustion events that took place at Fukushima?

MR. RECKLEY: I'm not the technical expert. I've seen some of the work that I think Sandia has done, some of the work that EPRI has done as it tried to map through the migration of the hydrogen to the various parts of the Fukushima facility that ultimately led to the explosions in the reactor buildings.

MEMBER POWERS: It seems to me that at least that subset that I have seen which probably is more limited than what you've seen is it poses some real challenges because it doesn't square very well with the way hydrogen control has been investigated in the past. Hypotheses have been advanced based on code calculations that the reactor building was flooded with hydrogen that pushed all the air out. The steam in that hydrogen began to condense in the reactor building and pulled air in.

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You would be looking at hydrogen ignitors operating on the other side of the combustion triangle where they'd been tested. We typically test these things looking at devices for hydrogen control looking at how they behave as the hydrogen slowly builds up.

Now we'd be looking at them as how they behave as the oxygen slowly builds up in an otherwise hydrogen environment. That seems to be one challenge.

The other challenge that I see is for the life of me I can't figure out what initiated these combustion events because the plants did cold. I mean you haven't got valves opening that are creating sparks and things like that. There are no electrical valves. So that's not the source of them.

If you think in terms of a hot gas injection being the ignition source, then you have an ignition source that could prompt a deflagration of that far faster than any hydrogen control device, be it an ignitor or a passing catalytic hydrogen combiner could consume. Then you get a deflagration wave going through despite the

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existence of such things.

It just seems to me that based on at least what I have seen so far on these that we have kind of awkward situation with respect to hydrogen. It doesn't fit very well with the way we've done in the past.

MR. RECKLEY: Right. I'll acknowledge the limitations. I have a newcomer speaking versus technical expert. So I'll take that back.

I know for example your point on the hydrogen environment being steam-inerted and then that aspect goes away as the steam condenses. That general topic is addressed within SAMGs as cautions and not particularly protected against strongly one would say. But at least in the SAMGs there are cautions against if you're in that environment and that environment changes to be careful. For example, if you hadn't already powered the ignitors, don't power the ignitors then. Those kind of cautions are there. So it's recognized, but again you're pressing my knowledge at that point.

What we did was we broke this up largely as it had been broken up in the past by the

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five primary containment types at least the way we divided them up. Then we looked at issues.

One thing that we did do is we expanded a little bit beyond the first recommendation as it was written in 2011. 5.2 was originally just should other containments have reliable hardened vents and hydrogen control.

We did take what we had learned from the Mark 1 and Mark 2 activities and say vents in isolation is too simplistic. You need to look other failure modes. You need to look at the way of the vents not only in protecting containment overpressure but also supporting decay heat removal and other aspects.

So we came up with this table where we looked at various issues that we had identified and addressed through the Mark 1 and two activities. Then we applied it across the different containment types. And I'll go through each containment type in a little more detail.

ACRS CHAIR STETKAR: Bill, before you do that, one thing that I did stumble over a bit and you mentioned it just now orally is you make the argument for primarily PWRs. There are

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statements that says that the containments don't have a direct system interaction between core cooling functions and containment functions.

I'm not quite sure that that's true. Many plants take explicit credit for containment accident pressure to maintain operation of those core cooling systems. And if containment accident pressure goes away because the containment goes away, the core cooling systems go away. I would be careful about your thoughts.

MR. RECKLEY: I tried not to be as definitive as that because obviously these things interact and they're not totally independent.

ACRS CHAIR STETKAR: I'll now read a quote. AIce condenser containments or pressure suppression containments but like other PWR containments, they do not have a direct systems interaction between core cooling functions and containment.@ That's pretty definitive.

MR. RECKLEY: Definitely. We'll check for that. What I meant there was the RCIC type operation between the suppression pool and core cooling that the boilers have. There is a relationship that --

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ACRS CHAIR STETKAR: Low pressure pumps taking suction from the containment sump, either high pressure or low pressure recirc is to me exactly the same functional relationship. The pumps have to work to keep the core cool.

MR. RECKLEY: Right. I understand.

ACRS CHAIR STETKAR: Just be careful. You're carefully trying to dissociate different functions here to make an argument.

MR. RECKLEY: Right.

ACRS CHAIR STETKAR: That we don't need to be concerned about certain things.

MR. RECKLEY: We do get in the post Fukushima activities a little focused on the station blackout scenarios because that's the one that's in an extended loss of power scenario. But you're exactly right. When you're dealing with the others in PSH then containment accident pressure is an issue.

ACRS CHAIR STETKAR: Right.

MR. RECKLEY: So you have seen this graph many times. And this was basically the resolution for the Mark 1s and 2s and support of the Commission decision that additional regulatory

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action was not warranted. It shows basically the various alternatives and the numbers in terms of latent cancer fatalities.

MEMBER BLEY: Bill, go back to that one. We had a really long discussion with the folks who generated this a month or so ago. And clearly alternative one is not the status quo. Alternative one is something quite different. And we would do everyone a favor to get that right because it's really not. It's a set of hypothesized conditions.

MR. RECKLEY: Okay.

MEMBER BLEY: Please do that. Otherwise this creates an impression that isn't true.

MR. RECKLEY: Okay.

MEMBER BALLINGER: And expunge that slide.

(Laughter)

ACRS CHAIR STETKAR: No, the slide is actually very, very useful as long as you understand what alternative one and alternative two is in the context of alternative three and alternative four.

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MR. RECKLEY: Right.

ACRS CHAIR STETKAR: And what the plants currently have today.

MEMBER BALLINGER: That means changing the slide.

MR. RECKLEY: Yes.

ACRS CHAIR STETKAR: No.

MEMBER BALLINGER: Well, just changing that.

ACRS CHAIR STETKAR: Maybe just change it, but don't expunge it.

MR. RECKLEY: So it's the last time I'll use that slide. Okay.

(Laughter)

ACRS CHAIR STETKAR: The slide is a good slide. It tells a really good story except that you need --

MR. RECKLEY: As it stands. Without modification, it's the last time I'll use this slide.

As we also talked a little bit during the discussions on the order and the CPRR rulemaking, but we always deferred the more detailed discussion because it was recommendation

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six was for Mark 1s and 2s would we need to anything else in terms of hydrogen control. And this would be possibly putting vent systems in the reactor building or recombiners in the reactor building or take some action within the containment other than venting.

The analysis, again we talked about it a little bit in the discussion, but never to kind of put an end to it was the finding in the analysis that we did and it was mirrored by the work that EPRI did that the venting operations removed the hydrogen from the facility. So the hydrogen is going out with the rest of the material that's being vented.

And there was very little hydrogen that was left within the containment. And since those other activities associated with the order were preventing the loss of the containment, the lifting of the head, any release paths that we think occurred at Fukushima that hydrogen was not going to migrate to the reactor building. In the end, the conclusion is for Mark 1s and 2s the venting operation sufficiently addresses the hydrogen concerns and no additional regulatory action is

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required.

MEMBER RICCARDELLA: Excuse me. I don't think I understand this curve. You've got three things in the legend and I only see two curves on this.

MR. RECKLEY: That's because one is overlapped.

MR. BOWMAN: The blue and the green ones are together.

MR. RECKLEY: Basically, it's showing that containment and vented gets rid of all the hydrogen because it's the same curve.

MEMBER RICCARDELLA: Okay. Got it.

MR. RECKLEY: So if there's no further discussion on the hydrogen control for Mark 1s and 2s, we'll go onto the other containment designs. Looking at 5.2 and 6 for Mark 3s, ice condensers and large dry's.

I pulled just these. There are probably more recent figures. I just went back and pulled what I had easily had hand. This is from NUREG 1560 basically showing the relative frequencies for the various containment types of early releases. And this graph is mixing both core

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damage frequency and conditional containment failure probability. So it's basically showing that the plants are generally on par.

ACRS CHAIR STETKAR: Those numbers by the way just for the record are basically internal events at power operation. They don't handle external water shutdown.

MR. RECKLEY: Then the issue that was specifically pointed out for the reason that Mark 1s and 2s were set aside and made into Tier 1 to take an action was the conditional failure probability. And that's in this graph for the containment designs for station blackout in particular.

Again, this is an old curve. But most of the curves are showing something similar and I suppose it's not too surprising the smaller pressure suppression type containments. When you get to a station blackout scenario, we're going to have a higher conditional containment failure probability. So we gave particular attention to the Mark 3s and ice condensers as have previous studies.

Looking at the Mark 3 first, basically

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these slides are going back to this table and looking at the various aspects of containment performance and how we're looking at it. The first is that there is a dependence between core cooling and the suppression pool in the Mark 3s similar to what exists for the Mark 1s and 2s with RCIC systems.

That's specifically addressed within mitigating strategies with the maintenance of the core cooling function. Different than Mark 1s and 2s, the Mark 3s are generally addressing this not by venting the containment, but by establishing alternate suppression pool cooling.

So this is a heat exchanger system. They're setting up. They bringing in external power supplies because you're assuming in this case that they've lost the normal AC power. So they're bringing the backup diesels to power pumps and set up cooling loops for suppression pool cooling.

But that satisfies the purpose. It maintains the functionality of RCIC for long term operation as long as you keep the suppression pool cool.

The other thing that Mark 3s have is

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they have the upper pool and they're able to dump that upper pool down into the lower pool. That gives a significant amount of water that's also adding to keeping the suppression pool available.

Looking at maintaining core cooling, we think mitigating strategies has addressed that just like what was sometimes called anticipatory venting or early venting did for the Mark 1s and 2s.

Now you get into the actual containment pressure control. As I just mentioned for pre core damage that's addressed by mitigating strategies and the establishment of the alternate suppression pool cooling.

In post core damage, the SAMGs do talk about setting up measures including venting as necessary. The difference again between what they have available and what is now available for the Mark 1s and 2s is it's not, in our terminology, a reliable hardened vent. They're going to use existing plant features, containment purge, other kind of systems that were not necessarily designed for post accident venting.

But to the degree they're available the licensee uses those for venting under the SAMGs.

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They identified three or four different possible vent paths. And licensees will go through and identify which vent might be available depending on valves, plant conditions and so forth.

We did look at other containment failure modes and debris cooling. There have been some previous studies. I mention two here, NUREG/CR-5529 was an assessment of BWR Mark 3s. Specifically this was a kind of a part of the containment performance improvement program or shortly thereafter. And there was also a generic safety issue on hydrogen control in Mark 3s and then other studies such as NUREG 1150.

All of those together generally concluded that the concerns in regards to failure modes other than hydrogen which I'll come to were not at a level that warranted a regulatory action under the backfit. Looking back, they basically were being asked to make the same decision we're being asked to make now. We're looking to see if there's new information that's available to us. Finding none, we come to the same conclusion.

ACRS CHAIR STETKAR: And that conclusion applies -- I'm not at all familiar with

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the Mark 3 containments. I'm way out of my experience base here. But that conclusion also applies to not requiring hardened vents.

MR. RECKLEY: Yes. There are different ways to do that containment control. In some European countries, they're doing vent which maybe it's too simplistic put in a feed and bleed kind of scenario. You're adding water and you're venting. And the alternative to that is what the U.S. plants have decided to do which is to set up the alternate heat suppression pool cooling mechanism.

DR. SHACK: Isn't there one Mark 3 with a vent?

MR. RECKLEY: There is a Mark 3, but it wouldn't be a reliable hardened vent under our terminology. But it does have some venting that's a little better than the other three have.

Looking at the ice condensers also under 5.2, it's going to be a very similar discussion because in terms of size and features there are some similarities between the two containment types. Again, we'll go back and look at the language, but in terms for --

ACRS CHAIR STETKAR: Think about that

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carefully, Bill, because there is this tendency post Fukushima to get pigeonholed into this no AC power.

MR. RECKLEY: Right.

ACRS CHAIR STETKAR: And we'll resolve issues under that presumption. The issues might be broader than that.

MR. RECKLEY: Okay. It's a good point. The containment pressure control under pre-core damage conditions mitigating strategies does have that addressed. The Order 1249 requires measures be it containment sprays or other heat removal mechanisms. And then post core damage again, SAMGs and ice condensers like the Mark 3s do have provisions identified for venting or taking other actions. Again, it's not going to be systems necessarily designed for that function. It's going to be existing systems that they're trying to use under accident conditions. But they have preidentified them in the SAMGs and they're going to look for vent paths.

Looking at other failure modes, again most of the studies like Mark 3s, the ice condensers, the biggest concern was identified in

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the studies that were done in the >80s and early >90s was hydrogen. There are other failure mechanisms, but they didn't raise to a level that warranted regulatory action.

Then the release reduction one as in Mark 3s, basically if you go down this hierarchy, if you're not able to justify taking a regulatory action to require reliable, hardened events, then you're not going to be able to justify putting a filter on a system that's not been engineered for that.

Now looking at hydrogen, again for Mark 3s and ice condensers, hydrogen in most of the previous studies was identified as an issue. That is why these containment designs have ignitor systems.

And then the issue that was identified under GSI-189 and then under some of the previous studies as I mentioned under the NUREG/CR was you need powers for the ignitors. And so GSI-189 was for both Mark 3s and ice condensers. For those station backout scenarios, you have the build-up of hydrogen, but you don't have the ignitors because they lost power.

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Part of the resolution of that GsI-189 was that licensees made commitments to have dedicated backup power just for the ignitors. We accepted that regulatory commitment.

And then post Fukushima, the backup power to the ignitors was specifically put into the guidance for compliance with Order EA-12-49. And so that's now captured. What was a regulatory commitment is now a regulatory requirement under the order.

ACRS CHAIR STETKAR: So that backup power now is part of the onsite, portable equipment for phase two of the response.

MR. RECKLEY: Right.

SUBCOMMITTEE CHAIR SCHULTZ: Bill, in each of these areas the discussion refers to international activities that the staff has interacted with the international community, has researched, evaluated what the international community has done with regard to hydrogen control venting and filters.

Have you documented or can you elaborate on that interaction of what has been learned and what conclusions have been drawn as a

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result of those activities? Their programs are going in a different direction.

MR. RECKLEY: And in many cases just like the engineered filters, the international community is going in a different direction. Many countries are putting in the passive, automatic recombiners, PARs, into containments and some into adjacent structures like reactor buildings. That's probably the biggest difference is the international adoption of that technology if you will.

ACRS CHAIR STETKAR: Many plants are also installing filtered vents on large dry containments.

MR. RECKLEY: Yes. I said engineered filters not only on Mark 1s and 2s, but on all containment types.

ACRS CHAIR STETKAR: Right.

MR. RECKLEY: And related vent systems. So they're not only putting in the filter, but the vent systems are being beefed up.

As a general matter both many European and Asian countries are beefing up the severe accident capabilities if you will beyond what the

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U.S. is. And that is largely because of the different regulatory structures. We have the severe accident policy statement and we have the backfit rule.

When you do the assessments, it's very hard to come away with a justification that satisfies the backfit rule for these severe accident capabilities. That's primarily the reason you see a difference between what many countries are doing and what the U.S. is doing.

SUBCOMMITTEE CHAIR SCHULTZ: Thank you.

MR. RECKLEY: Looking at the large dries, they have historically not been as much of an issue. Maybe it wasn't intended, but they're kind of a passive aspect to a large dry containment. This is basically showing the results of the SOARCA analysis for Peach Bottom and Surry, showing them to be comparable. If the risks are comparable and you can see the dotted line for the safety goals, the margins to the QHOs are going to be comparable and the backfit finding will be the same.

ACRS CHAIR STETKAR: One thing also, Bill, and we had some discussion with this

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internally, the CRR, when you present these things, you're very careful to say scenario specific risk for latent cancer fatalities. Those safety goals are for all scenarios.

MR. RECKLEY: Yes. That's a very --

ACRS CHAIR STETKAR: So when you talk about margins comparing a specific scenario to these margins is dangerous. And these margins are very large obviously.

MR. RECKLEY: Right. And we do have -- I know it's subtle. We had no footnotes and things in places that try to make exactly that point. The QHOs are aggregated risks.

And when you look at a particular scenario or you look at particular backfit in terms of assessing a plant enhancement, there has to be considerable margin. You're looking at slice versus the aggregate. But in this particular case as you mentioned, Dr. Stetkar, you're like two orders of magnitude. But that is something that the staff has to think about.

ACRS CHAIR STETKAR: Two orders of magnitude if you had 1,000 of these you would be over it. But a slightly different scenario.

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MR. RECKLEY: Yes.

ACRS CHAIR STETKAR: Just be careful making those comparisons because they can be misleading regardless of how to try to qualify them in statements that insiders may understand, but others may not appreciate the subtleties.

MR. RECKLEY: Having gone through the containments, then the staff does not expect that regulatory actions beyond those that we've already taken. That's always an important thing to come back to. It's not as if these containments were impacted by mitigating strategies and other actions that we've taken. But actions beyond that are not foreseen.

We laid out the argument that you've seen in the slides and in the draft paper. Our plans are to interact with the ACRS and external stakeholders to develop a more detailed documentation of those, some of the references to more material.

We've done some other work that we can bring in that supports the discussion. But basically the discussion that you've seen and heard is the discussion that would be in the paper. And

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we would provide that in a paper to the Commission in the time frame of March of next year.

I just wanted to emphasize that absent new information from stakeholders what you've seen is what we would expect to document.

So it's unlike something where we say we haven't made up our mind. Please come and give us your views. This is more like this is a draft position and you can comment and challenge it on it. But it's more like a draft position in that context.

MR. BOWMAN: Bill, Steve had a question at the beginning about what our time frames were for doing the things that need to happen before March of 2016. Can you expand on that at all?

SUBCOMMITTEE CHAIR SCHULTZ: Yes, I was trying to get that appreciation when you said in the time frame of March of next year.

MR. RECKLEY: We would have to come back and there's a couple of things in play here that we have to try to -- We're planning as if this is our schedule, but we have to keep in the back of our minds that the Commission can say that they're satisfied with the argument preliminary as it may

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be in the current paper.

MR. BOWMAN: Or they could say for other recommendations that you have in group one we think they should be in group two. So there is some level of uncertainty in terms of what would happen before March of 2016 just because of where we are in the process.

MR. RECKLEY: There's a number of balls in the air. The Commission meeting and the Commission vote on the paper is one. But we would expect to start working with the ACRS staff to look probably in the January time frame at the more detailed write-up.

ACRS CHAIR STETKAR: Start doing that as soon as possible because our schedule even out in January is already full in terms of subcommittee meetings.

SUBCOMMITTEE CHAIR SCHULTZ: In terms of scheduling, that's important for us. Also I appreciate what you said regarding the positions or recommendations for the various groups. In other words, we have group one which is going to be a recommendation for a particular action. Do no more work or do work in the future, but it would be of

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this character.

And you've said then for group two the description would be we're making a recommendation that could be challenged. But we expect that in March if we aren't challenged significantly we are going to maintain that recommendation. That character of what is intended by the group two discussion is important for us and for the Commission to understand.

That goes back to what you said earlier, Greg. I think that's a better definition than what we started in the introduction. That is you're trying to lay this out for the Commission to be able to provide their early feedback if they wish regarding any of these topics as it relates to your recommendation. So you're characterizing these somewhat specifically moving forward with group one, group two, group three as to where your thinking is and how firm your thinking is.

MR. BOWMAN: I think the biggest distinction between group one and group two is that group two we think there is the benefit of having additional interaction with stakeholders. We have not had the time to do that yet. So that's largely

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the distinction.

Even for the group two recommendations as I mentioned in the beginning, we did try to put as much of the basis for where we think we're going to end up in the paper both for the Commission to weigh in on and also for the stakeholders that we need to engage with to have a starting point to discuss with us.

ACRS CHAIR STETKAR: Steve, I think it's important for us, ACRS, because the full Committee will hear this in our November meeting to understand that subtlety because group three is being characterized as further discussions and what I'll call substantive technical discussions are needed.

SUBCOMMITTEE CHAIR SCHULTZ: Over the course of the next 12 months if you will.

ACRS CHAIR STETKAR: Yes.

SUBCOMMITTEE CHAIR SCHULTZ: But it wasn't a subtlety. It was just I wanted to really catch what the differentiation was between group one and group two. And what you're saying is that you're making recommendations in the paper -- what I hear you saying -- and they're 95 percent of the

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way to where you believe they will be in March. You're providing some additional information, but it's only to polish them up.

MR. BOWMAN: That's accurate.

SUBCOMMITTEE CHAIR SCHULTZ: And absent substantial challenge they will be the same as we're seeing in the paper now.

MR. BOWMAN: Yes, that's accurate.

SUBCOMMITTEE CHAIR SCHULTZ: Or that we'll see at the end of the month, this month, October.

MR. BOWMAN: Any other questions for Bill?

(No verbal response)

Go to the next slide. So the next slide is a group one recommendation. This is Recommendation 12.1. That was a recommendation from the task force to expand the ROP self assessment process and the biannual ROP realignment to include defense in depth considerations.

This recommendation was characterized as a Tier 3 recommendation because of its dependency on Recommendation 1 which has now been closed to risk management regulatory framework,

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that initiative. And it's being addressed outside the scope of Fukushima lessons learned. There is a SECY paper due to the Commission at the end of this year that will talk about RMRF or risk management regulatory framework initiative.

We have discussed in our periodic updates to the Commission under this recommendation some of the other things we've been doing to enhance the ROP. The most significant of which is our work on TI, Temporary Instruction, 2515.191 which is the inspection that we're doing to look at implementation of mitigating strategies and some of the emergency preparedness enhancements that took place after the accident.

Most of the TI inspections will take place in 2016 and 2017. What it will ultimately be used to do is to inform more permanent inspection program changes coming out of the accident.

There are also activities going on outside of the scope of Fukushima that we're working on to modify the ROP self assessment and realignment process which was the original intent of the recommendation or the original focus of the recommendation.

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SUBCOMMITTEE CHAIR SCHULTZ: Greg, is the temporary inspection document 2515.191 the change to the BIP, the change to the baseline inspection program?

MR. BOWMAN: No, there are other things. In the second dash there, there have been other things like -- and I'll get to this in the next slide -- changes to the flood inspection procedures that we do based on lessons learned from the walkdown we had after the accident. So there have been a number of changes like that that we've also made.

The 2515.191 is what's going to look at mitigating strategies. It's like temporary instructions. So it's a temporary inspection procedure, one we use for each plant. Once we've gained all the insights from those temporary instructions or temporary inspections, we'll create more permanent inspection procedures that we'll use going forward.

SUBCOMMITTEE CHAIR SCHULTZ: Thank you.

MR. BOWMAN: Given that the intent of the recommendation which was originally focused on getting recommendation into the realignment process

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isn't applicable anymore. We think it's appropriate to close recommendation 12.1 now.

The activities we have ongoing associated with the inspection program development will continue on their current path for many, many years. For example, we'll be doing inspections of vent related activities in the 2019-2020 time frame when licensees have implemented those orders. But those inspection activities we'll be doing more the backend process of the Tier 1 activities and they don't need to be tracked separately as this Tier 3 recommendation.

We have well established processes for dealing with inspection program enhancements, the ROP feedback process being the primary one where when we do these inspections insights and concerns from the inspectors get inputted into the ROP feedback process. We consider them and adjust if necessary.

With respect to the ROP realignment and reassessment processes which were like I said the original intent of the recommendation, the staff and our Division of Inspection Regional Support are actually working on revising those processes

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outside the scope of Fukushima. And one of the things they might consider depending on where RMRP comes out is whether we need to include defense in depth considerations in those processes.

The bottom line of the recommendation is that we would close this recommendation now and that future ROP enhancements would be essentially treated as part of the underlying safety enhancement that we're going to look at.

ACRS CHAIR STETKAR: Greg, I wanted to let you get through before I asked.

MR. BOWMAN: I saw you were ready with something.

ACRS CHAIR STETKAR: Before I ask something that kind of bothered me. As I read through this, it seems like you went from a recommendation that says expand the scope of the ROP self assessment and biennial ROP realignment to more fully include defense in depth considerations to something that says we can close this out because the ROP is going to think about Fukushima related stuff.

MR. BOWMAN: Right.

ACRS CHAIR STETKAR: And I don't get

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that. I mean I understand the ROP looking at Fukushima related stuff because it ought to. But I don't understand how that resolves this notion that the ROP should somehow more fully consider defense in depth considerations holistically.

MR. BOWMAN: This recommendation 12.1 was tied to recommendation 1.

ACRS CHAIR STETKAR: It sure was.

MR. BOWMAN: And what we could have done is closed this recommendation when we closed recommendation one.

ACRS CHAIR STETKAR: But the Commission closed recommendation 1, but it said go forth and continue that discussion in the context of RMRF which you refer to here. So why isn't this just continued until RMRF gets resolved?

MR. BOWMAN: Because we have processes in place once our RMRF is done which may be many years down the road for incorporating things like defense in depth into those processes with the interim task force specifically called out.

ACRS CHAIR STETKAR: But to me I'm looking for a politically correct term for the concept of bate and switch.

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(Laughter)

MR. BOWMAN: Too late.

ACRS CHAIR STETKAR: And I can't quickly find one.

MEMBER BLEY: I think you no longer need it.

ACRS CHAIR STETKAR: Hence the way I phrased that. It to me says we're going to call this thing something else so that we can say we closed it out. And that bothers me a bit.

MR. BOWMAN: I don't think that's the case. I think we have processes for dealing with new whatever RMRF firms up. We have processes for dealing with that. We have like I mentioned the baseline realignment process and the annual self assessment. Those will give us the option of including defense in depth in them when they've been updated.

ACRS CHAIR STETKAR: But why doesn't the text -- To me the text didn't say that. The text said we're going to put all of that other stuff aside and now we're going to reinterpret what we think that the recommendation meant which is the ROP should address Fukushima issues like the

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inspections that you mentioned and others that may come up. And on that basis we're going to close out this recommendation. I don't get that.

MR. BOWEN: And in many respects -- I understand the comment, Dr. Stetkar -- that is somewhat the approach as has been the approach of many of the Tier 1 activities. The original recommendation may have had one thing in mind. Throughout the past five years, the activities or the actions that are ongoing have evolved. The flooding and seismic activities are a perfect example of that.

The original recommendations said go do X. And we evolved what that was based on actually implementing the activity.

As Greg mentioned, the original recommendation was as you read tied very closely to the recommendation one. With recommendation one being closed to the RMRF, we took the opportunity to relook at the recommendation and see what was appropriate considering where we are today.

Then given that information, the discussion Greg went through, that's kind of where we think we're at. Given the fact that there's

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existing processes if there's anything that comes out of the RMRF, risk management regulatory framework, activity the existing ROP processes provide an opportunity for that information to be fed into it.

ACRS CHAIR STETKAR: I understand that and I have no problem with that. I have a problem with the way you're saying that this thing is resolved. I mean I have no problem with -- in the document. In the written document that I've read.

MR. BOWMAN: We can go back and look at the document to ensure that it characterizes that the way we intend. The reason we have a lot of discussion that's about the ROP, the enhancements we've made is not --

ACRS CHAIR STETKAR: AFor this reason, the staff@ -- this is writing -- proposes that the resolution of recommendation 12.1 no longer be considered dependent on the RMRF project.@ Now that's not what I heard you say orally.

MR. BOWMAN: So what that means is we wouldn't keep the recommendation open until the RMRF process is done. That's what that language means.

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MR. BOWEN: We'd rely on the fact that there's existing processes to be there.

MEMBER BLEY: It's hard for me to hear that.

ACRS CHAIR STETKAR: We don't like that. I don't care for the way that's stated.

MR. BOWMAN: We understand the feedback. But a lot of the discussion on the slide is focused on inspection program enhancements. That was not intended to be a bait and switch. Over the years this discussion of this recommendation has evolved to include a discussion or more things than just those.

ACRS CHAIR STETKAR: But, Greg, if you use the argument depending on how the RMRF is resolved eventually that the ROP would need to account for that eventually. The ROP obviously has to account for the orders and any potential rulemaking associated with Fukushima.

MR. BOWMAN: Right.

ACRS CHAIR STETKAR: So all of this discussion of yes indeed the ROP is being enhanced to account for all of that is similarly just a pro forma thing that needs to be done anyway regardless

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of that NTTF recommendation about defense in depth throughout the ROP process. That's my whole point is that even if that recommendation 12.1 did not ever exist the ROP would have to be enhanced to include inspections of all of the close Fukushima orders.

MR. BOWMAN: From my perspective, this is really just a function of us taking -- Right now, we're essentially tracking ROP enhancements under both the underlying enhancements, for example, mitigating strategies order. We're taking care of inspection program enhancements at the back end of implementation of that.

We're also tracking under this with RMRF. We're taking care of changes coming out that as part of our RMRF, but we're also tracking it under this. Our thought is we're not going to do it much differently.

But the recommendation is going to be closed because we have those other processes that will handle the future actions. That's what we had intended. But that didn't come across.

ACRS CHAIR STETKAR: It did not in the paper anyway.

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SUBCOMMITTEE CHAIR SCHULTZ: My reaction to the way you described this slide is that it was a mouthful. As you described all of those things that were going to be incorporated into the ROP that's inspection process, the ROP process, the post Fukushima reviews and feedback.

It all sounds good at a high level. But there's a lot of detailed process elements that need to be not only fleshed out but assured that they move forward in the appropriate way. The ROP process, we're reviewing that for its current enhancement that's happening right now. Here we're talking about something in addition to. We know that the last effort took a few years to get done.

All I'm saying is that if we're going to push all of this into that inspection and ROP process, then we need to carefully describe what the expectations are for that piece of work moving forward rather than just say our normal processes can now take care of this. We're adding a lot in that bucket.

MR. BOWMAN: We can take a look at that. I understand the feedback. Are there any other questions on this recommendation?

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We're at the point where we were going to take a break. Steve, do you want me to go --

SUBCOMMITTEE CHAIR SCHULTZ: What we had done as we walk through this with the staff in preparation is after a couple of presentation we thought it would be appropriate for the Committee to reflect.

So this break since it's not time for lunch will just be an opportunity for us to sit for a moment and see if there are any questions to ask of Bill or Breg or Jeremy on the three-four topics that we described and discussed here. Anything from members? Hearing none, we can move on. Go ahead, Dick.

MEMBER SKILLMAN: It seems that in the last several topics what has come to the staff from the ACRS members is kind of a gentle challenge. From the perspective if you look at the original recommendation and you look at what you're proposing today, they are not aligned. There is difference.

My question is in your descriptive document, have you communicated here was the content of the original recommendation, here is our

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interpretation of how we're going to respond to this and here is why this is consistent with this document that had wide distribution, a lot of people, public folks and industry, tuned in on this document. Then there isn't the notion of bate and switch.

MR. BOWMAN: The paper does discuss for each recommendation what the initial task force recommended and it discusses where we're ending up. You have to recognize that the task force was created very shortly after the accident. They had a very short period of time to put together a very comprehensive report.

I think for many of them our thinking has evolved significantly since the time the task force finished their work. With the mitigating strategies order, for example, the work we've done there has gone well beyond what the task force recommended.

It's hard for us to go back to the task force to say AHere are the words of the recommendation. Here is why we agree or disagree. Here's what we're doing.@ But we certainly think we met the intent and I think that's documented in

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the paper that we're going to send forth.

MR. BOWEN: That's intended to try and be captured in really the status discussion of each recommendation, why it's evolved, how it's evolved, what the current thinking is if you will and then based on that what the recommendation now is. What our path forward is.

ACRS CHAIR STETKAR: In fairness, I'm going to rue the rouse of the term I used. As I read through it, I think this last one we discussed was the only one as I read through the document where I made those notes in the margin that seemed to indicate that there was a fundamental reinterpretation.

The other ones I'm not going to say whether I agree with the train of thought that's laid out in each of the other ones. But the train of thought I think comes through by and large. There is some continuity and nexus. This last one was the only one that I saw a distinction change or at least in the way I interpreted the words.

MR. BOWEN: We appreciate the feedback on that one. Really very crudely a summary of the last one, the ROP one is really that the original

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recommendation is addressed or will be addressed through activities, normal processes dependent upon the RMRF. The other items that are discussed are nice to know, if you will, information that has been an outflow of all the post Fukushima activities as Steve said and Dr. Stetkar mentioned as well as the things that already have to be done as part of the outcome of the orders and the rule and everything. It's kind of a nice to know if you will.

MR. BOWMAN: In a sense we did it to ourselves. We made this complicated ourselves because over the years instead of just focusing on what the task force's recommendation was we started to pull things in that really were outside the scope of the initial recommendation.

All these things on the slide are outside what the initial recommendation said, not all of them, but the majority. The ROP enhancements, the inspection procedure enhancements, those were not the focus of this recommendation.

ACRS CHAIR STETKAR: And that's my whole point.

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MR. BOWMAN: Yes, I know.

ACRS CHAIR STETKAR: Because all of those other things would have needed to be done anyway as part of the necessary consequence of the other regulatory actions.

MR. BOWMAN: That's true. That's very good.

SUBCOMMITTEE CHAIR SCHULTZ: Just reflecting on the categorization that has been selected for hydrogen and thinking of Dana's comment that with respect to Fukushima I presume that you've got a bring back item, Bill, for the January time frame as the staff experts related to, the hydrogen control.

My question is more general. There are some things about the Fukushima accident that we have not fully understood. The investigation with regard to the accident continues. And yet we have these categories of go do items that came from the task force and we're trying to close them out.

It seems like for some of them -- I hope not for each of them -- we would have remarks and discussion about topics where we conclude that more research is required. More discussion needs

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to be held as more is found out about the accident either through research or through investigation. Are we going to have a component, a tiered approach if you will, for hydrogen for example that says there are some features that we may not be able to explain and there is a research component that is going to continue?

MR. RECKLEY: I think there will be, although I'm not sure I can point to it specifically. I mean there will be ongoing work as part of the SOARCA work on Sequoyah. There will be ongoing work as we continue to work at the NRC and then through cooperation with DOE and others on the reconstruction of Fukushima. That continues out for some time. And then ongoing research in general and I'll looking at the Office of Research, Mr. Case is going to make his way to the microphone.

I think as you read through these one of the distinctions that I think we've tried to make is there's ongoing work. Actually, there was ongoing work before Fukushima. There will be ongoing work after we close out these items. And should any of that work identify an issue, we have

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the generic issue program or other programs to evaluate what action we should take.

Mr. Case, do you have something?

MR. CASE: This is Mike Case, Director of the Division of Safety Analysis and Research. Yes, we will.

ACRS CHAIR STETKAR: I don't know if you turned it on or turned it off.

MR. CASE: Okay. In any event, you'll hear more about our ongoing plans at least in the severe accident area from Dr. Lee in the afternoon agenda. The role that research plays in some of these generally in the agencies, we're like Dr. Powers. We want to understand these things.

So I think what we're trying to say is there are some things that we need to do now and there are some things that we see that we're going to continue on including some of the hydrogen issues. Now whether Dr. Powers' hydrogen issue was on Dr. Lee's list at this point I'm not sure. But we can ask him that.

And then we would do a normal process. If that's an important issue that you highlight to us, that will rise on our list of things that we

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intend to do in the hydrogen area. There are things that we do research wise that we are doing now only we will continue to do in the hydrogen area.

I think the question for the Tier 3 item is are we finding things that we need to do now. And we're taking a look in the context of this review as is that what we're trying to identify for our partners. Based on our knowledge of all the work we're doing, are there now issues that would preclude closing out the Tier 3 issues? Or do they all look like ongoing issues that we want to get to a resolution on but it's not a now issue? So you'll hear more in the afternoon. That's my basic point.

SUBCOMMITTEE CHAIR SCHULTZ: What I was reacting to is there's a regulatory component which you described and then there's a research component or an ongoing activity in terms of investigation. I think it's important that that be very clearly described and in your SECY document in the preamble to be sure that it's understood what we can close out this issue means. In that regulatory component that's fine.

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But perhaps in some cases you need to then augment that to identify that there is a research component that continues. It may be appropriate for some of these categories.

MR. BOWMAN: The body of the SECY paper, the front matter, does have a paragraph that discussed the fact that regardless of where we end up with these recommendations we'll be doing severe accident research for many, many years. There will be dose estimates going around Fukushima that we'll be looking at for many, many years. There's work that will continue on.

SUBCOMMITTEE CHAIR SCHULTZ: But that's a general comment. I'm trying to address what John brought up earlier and Dennis as well. As we're trying to communicate this to the Commissioners and to the public, it's important that we be clear what we mean when we say this issue can be closed. If there are other elements that need to be addressed, then we ought to find some way to make that clear.

ACRS CHAIR STETKAR: Because this is written in the context of the near term task force and it's not clear to me that they were thinking in a focused sense in the context of do we resolve

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these issues strictly from the perspective of can we justify promulgation of rulemaking or not. I think they -- It's my impression that the task force raised them as broader issues that need to be considered throughout the agency.

And yea verily, if it's important enough to justify going down the path of rulemaking, that's one way to consider it. But there may be other ways to consider it. And the SECY paper seems to have narrowed the focus of the resolutions to does the staff conclude that the issue is of sufficient importance to justify rulemaking or to not justify rulemaking.

MR. BOWMAN: That was our focus.

ACRS CHAIR STETKAR: That switch.

MR. BOWMAN: Yes.

ACRS CHAIR STETKAR: And that's why I agree with you, Steve. I think that somehow stating that very, very clearly in the introduction to the SECY paper so that as you said both the Commission and certainly members of the public understand that perspective. It's quite important for some of these issues and we've just discussed a couple of them this morning.

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MEMBER BLEY: I guess just one last thing along that line. It's also an image thing. We are going to learn some things over the next ten years as more and more information comes out of Fukushima. And if somebody gets the impression that we think it's done and we're not learning anything more and then we do, we don't look so good.

MR. BOWMAN: Did you want to move on?

SUBCOMMITTEE CHAIR SCHULTZ: Yes, I think we should move forward then, Greg. Thank you.

MR. BOWMAN: Could you go to slide 47. I'm going to skip to this one because it's one of the shorter ones we have, the instrumentation one, which is next in our presentation is a more -- Is that okay?

SUBCOMMITTEE CHAIR SCHULTZ: Yes, I think so. Let's do it that way.

MR. BOWMAN: The instrumentation one I think we have people that we need to get here. Are you ready?

SUBCOMMITTEE CHAIR SCHULTZ: We are ready, yes. Slide 47.

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MR. BOWMAN: We're on slide 47.

SUBCOMMITTEE CHAIR SCHULTZ: We have to be clear because people on the phone have the slides, but they won't know where we are unless we are clear.

MR. BOWMAN: Slide 47, that's recommendation 12.2 which talks about a near term task force recommendation to improve training for inspectors and for NRC staff in general on severe accidents and severe accident management guidelines. This recommendation was categorized as a Tier 3 recommendation because of its dependency on recommendation eight. Recommendation eight deals with strengthening and integrating onsite emergency response capabilities. And that is a recommendation that's included in the scope of the mitigation of beyond design basis and that's rulemaking.

We have completed a number of activities under this recommendation already. Research has put in place periodic training on severe accidents and those courses are available to any NRC staff in iLearn.

Some existing training courses like

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R800 course have been updated to include discussion of the accident. Our technical training center is currently working on developing a training course on SAMGs. I believe they're actually taking an existing course and revitalizing it essentially. That should be done in 2016.

And then we've also been working on qualification program updates both for inspectors for the staff in my office, the Office of Nuclear Reactor Regulation. The NRR qualification programs have been updated to include the lessons learned from the accident and the inspector one is in progress.

We also began, outside the scope of this recommendation, work on some general knowledge management activities associated with the accident, things like why the NRC did what it did, how we got from the accident to where we are now, so that ten years down the road we'll have a good understanding of why we are where we are essentially. That's where we are now. If you could go to the next slide.

MEMBER POWERS: Well, I just have to eject that R800 is a brilliant course.

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MR. BOWMAN: Of course.

(Laughter)

ACRS CHAIR STETKAR: It's a pity that the instructor quality will suddenly fall off the edge of the face of the earth when certain people retire.

MEMBER POWERS: Well, the instructor quality must have jumped dramatically because the previous baldheaded one no longer does it. But the content which is what we want to discuss here is just brilliant.

MR. BOWMAN: Like with the previous recommendation, we think we've made sufficient progress on the initiatives that I mentioned in the previous slide that we can close this recommendation. Once the SAMG course is completed in 2016, we plan on sending out a notification to all the staff basically outlining all the different training enhancements that we've made.

Just in part back to the previous question, we do note that there's ongoing research on severe accidents and severe accident progression and that's going to continue. We will continue to learn from that and in the future that may result

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in additional training enhancements, additional training like the ones that research is doing. So that will continue on for forever. Our recommendation would be that this be closed in this October paper.

MEMBER BROWN: I want to make one observation and I also want to pass on a comment from a colleague. In other words, her look at this, you know who I'm talking about, Member Rempe -- was that understanding the SAMG training, we're going to do all that good stuff and not argue about that. But yet based on her reviews and her other examinations of stuff, there seems to be here a lack of how do you train operators to have data? This is harkening back to the previous subject we hadn't talked about, the accident based instrumentation and containment instrumentation. How do you train them to evaluate the data relative to when they're dealing with toasted instruments? I'm using kind of a cryptic terminology, but when you don't know what's what and what's failed, what's good and what's bad. How do you provide training to allow them to provide those assessments?

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There doesn't seem to be a whole lot of detail. I recognize these are in process, but there is no listing or even inclusion of that. It's all in terms of or seems to be in terms of all the other what I call blacksmith technology side of the house, you know, the pipes and valves and flex power and all that type of stuff.

MR. BOWMAN: So the focus of this recommendation was internal training for the NRC staff.

MEMBER BROWN: Oh, this is staff only. I'm sorry. I misunderstood.

ACRS CHAIR STETKAR: Yes, the instrumentation section when we get to it this afternoon talks an awful lot about SAMGs and alternative ways of understanding what's going on.

MEMBER BROWN: Yes, I've read through the stuff. I saw this one and I just didn't realize this was NRC staff as opposed to plant staff. I apologize for that.

SUBCOMMITTEE CHAIR SCHULTZ: Greg, what's envisioned to the periodicity of training, the training for staff as well as for the inspectors? And is there a feedback process that

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has been established in that program?

MR. BOWMAN: I think they're still working out the details of the periodicity of the training. My assumption is that it would be part of the initial inspector training program, some component of that. And then the inspectors have to periodically go back -- I think it's every two or three years -- and get refresher training essentially. It has to be worked out yet, but I believe that's the intent.

And then as part of normal training there is a feedback mechanism where anytime you attend a training activity you have give feedback on whether the training was effective, whether there's improvements to make. So that would just be part of the normal process.

I would expect that as they develop this training program they would pilot it to that they have up front insights from people who attended it the first time. That would also be part of the normal process for developing new training.

MR. BOWEN: The agency has a working group on staff training and inspector training and

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an executive steering committee for that and they provide constant feedback. This is really envisioned to be basically another line item in the qualification program. And then as part of the ongoing inspector requalification or maintaining qualifications, it would be part of that.

SUBCOMMITTEE CHAIR SCHULTZ: And here in this section we're talking about the mechanisms of the severe accident, that element of the training, because we talked just before about other features of the SAMGs that inspectors are going to be responsible for in terms of assuring the adequacy of the programs that were being implemented by the licensees site by site. That's a different feature and not this one.

MR. BOWMAN: Right. There are two different components of this recommendation. One is training on severe accidents and that's the work that Research has been doing to put together seminars that are ongoing. The second aspect is training our inspectors on the SAMGs will be implemented. That is a separate piece.

MR. BOWEN: Yes, the aspect from the standpoint of NRC performing its EP function versus

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the NRC performing its oversight function.

ACRS CHAIR STETKAR: Where in those two elements of the training does the EPRI background fairly large technical basis report that's been used -- it's my understanding because we really haven't seen the SAMGs -- as a basis for developing the SAMGs. Where does that fit in to headquarters staff training? I understand severe accident. You know I don't understand severe accidents. I understand the concept of training on the physics of severe accident progression. I understand from the inspector's perspective what you look for in terms of implementation of already created SAMGs. What I'm missing is the transition from that severe accident to the technical bases for why are the SAMGs written the way they're written. Do you follow me?

MR. BOWMAN: Yes, I understand the question.

MR. BOWMAN: Or do you not care about that?

MR. BOWMAN: Well, under this recommendation I do not know if that -- I would expect that technical basis for the SAMGs would be

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something we would consider as part of developing the training. But I also think as we develop the oversight program for SAMGs that would come into that more. We would develop the inspector program, teaching inspectors why things say what they say.

ACRS CHAIR STETKAR: That's what I was trying to get at. Rather than just an inspector saying because the SAMGs are not written -- again it's my understanding -- as typical step by step procedures to understand. Whether a plant's implementing SAMGs and training their personnel appropriately on the SAMGs requires those inspectors to understand the underlying technical bases for what you're trying to accomplish.

MR. BOWMAN: So the Commission did task us in the SRM for the mitigation beyond design basis rulemaking to develop the inspection program voluntarily.

ACRS CHAIR STETKAR: Exactly.

MR. BOWMAN: I think that would be a component of developing that inspection program.

ACRS CHAIR STETKAR: I would certainly hope so.

MR. BOWMAN: Yes.

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ACRS CHAIR STETKAR: Because what I heard you say was more in terms of training the inspectors on -- Given the SAMGs are people training their operators? Or do people have the appropriate hardware to support it and all that kind of stuff?

SUBCOMMITTEE CHAIR SCHULTZ: Any other comments related to this topic?

(No verbal response)

All right. We can go through the next two slides which one topic within emergency planning.

MR. BOWMAN: I can go through this. If we have questions it might need to wait until the afternoon. If they're detail questions, I'll need help from NSIR since we are ahead.

ACRS CHAIR STETKAR: We should wait.

SUBCOMMITTEE CHAIR SCHULTZ: We'll wait until after lunch.

MR. BOWMAN: Okay.

SUBCOMMITTEE CHAIR SCHULTZ: In which case I'll call a break for lunch. And if we can reassemble in an hour at 12:45 p.m. And start lunch then. Is that a problem for anyone on the

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Committee? Off the record.

(Whereupon, at 11:45 a.m., the above-entitled matter recessed to return at 12:45 p.m. the same day.)

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

12:46 P.M.

SUBCOMMITTEE CHAIR SCHULTZ: Back on the record. The topic we're going to cover now is on slide 38 returning back to the topic of reactor and containment instrumentation for beyond design basis conditions. And this has been classified Group 2.

Greg, I'll turn it over to you for a moment to introduce the topic.

MR. G. BOWMAN: So as you mentioned, we'll be talking about reactor and containment instrumentation now. That was an ACRS recommendation. We have Russ Sydnor from the Division of Engineering and Research and Joseph Sebrowsky, one of my project managers, to cover that recommendation for us.

So Joe, if you want to go ahead?

MR. SEBROWSKY: So my name is Joe Sebrowsky. I work for Greg, my project manager, in the Office of Nuclear Reactor Regulation in the Japan Lessons Learned Division. And as Greg noted, this reactor and containment instrumentation issue was based on an ACRS recommendation and it came about as a result of your review of the Near Term Task Force report and during your review of the Near Term Task Force report, you noted that there were significant

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challenges in understanding the condition of the reactors, containments, and spent pool fuels because instrumentation was either lacking or giving erroneous readings. Based on this, the ACRS recommended an assessment of the need to enhance instrumentation to survive beyond design basis events.

The item was prioritized as a Tier 3 item because it required further staff study and depended on other Fukushima activities. It was mentioned that this is a Group 2 activity and Greg provided the definition of the different groupings this morning.

The subcommittee was previously briefed on this issue back in September by Russ on this issue, so Russ and I will go through the current status of the activity including the current status of interactions with domestic and international organizations, work related to Tier 1 activities including the recent Commission decision on mitigation of beyond design basis events rulemaking and the current status of a standard for severe accident instrumentation. And the standard, as Russ will talk about, if it's endorsed by the NRC, could be used by operating reactor licensees to voluntarily enhance reactor and containment instrumentation to survive severe accidents.

So with that, I'll turn it over to Russ.

MR. SYDNOR: Well, this slide just reminds the committee of what our project plan was going back two or three years. We essentially binned things in three different areas. One was to work with Tier 1 teams that had obvious interfaces with instrumentation needs. The second one was really probably the greater body of work in that we -- it was to look at past and on-going research efforts both nationally and internationally. So this got pretty expensive, and also to look at interface with industry standards organizations.

And then finally, our third task was going to be analyze what we found in both of those efforts to determine whether we needed to recommend additional regulatory action. So that was our three tasks.

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I'm going to talk about some things we did for task 1 and task 2 more specifically. And then Joe is going to take over and talk a little bit about how we interfaced with a couple of key Tier 1 activities, both of which are mentioned on the slide there under task 1.

In task 1, we reviewed and commented on a number of guidance documents that were being developed for mitigating strategies, being developed for containment vents or spent fuel pool instrumentation. Dave Rahn was on my team and Dave was directly supporting the spent fuel pool instrumentation order implementation and guidance development.

As the rulemaking team for mitigation of the beyond design basis events started firming up and it was consolidated into one rulemaking, we began much more active participation in that trying to influence that rulemaking to try to see if we could actually add requirements for instrumentation along with the requirements for severe accident management guidelines because that was a natural integration. I mean the instrumentation needs for severe accidents will be delineated in the severe accident management guidelines.

So those were some of the activities we engaged in. We did actually submit a proposed rule awarding for that rulemaking and we'll get into some of Joe's discussion, we'll get into how that was ultimately dispositioned.

For task 2, I really don't want to spend a lot of time on it. When we briefed you last September, we went through a lot of this in much more detail, but some of the more meaningful things we've actually engaged was developing of a technical document by the IAEA on accident monitoring systems and that technical document is a very thorough document. I'm actually going to talk about it in a later slide in a little more detail because it bears on where we're going with our recommendation. But there's also ongoing work there and a second technical team is looking at qualification and survivability of instrumentation. So we found some of the IAEA teamwork that Dave set up has been very useful.

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And then that work actually has influenced ongoing standards development with the IEEE. Even prior to Fukushima, the NRC Reg. Guide 1.97 endorses an IEEE standard, IEEE-497 which dealt with accident instrumentation, design basis accident instrumentation and post-accident instrumentation, but now there's a revision in process that is going to expand that to include spare accident instrumentation.

We look at --

MEMBER BROWN: I'm sorry, you said which one, 497?

MR. SYDNOR: 497. I'll talk about it more in detail. We had a lot of interface with DOE work. There was past research done that we took a look at. Some of that was actually in the ACRS letter that recommended this addition to the task force action items. And so we looked at those reports. There was some new work done by Oak Ridge and Idaho including two that are on the verge of being published that we commented on, one by Idaho and one by Oak Ridge, that actually took the SOARCA events using a MELCOR analysis and established numbers for what sort of environment would these instruments see in a severe accident. I think that work, when it's published, is going to be very useful to the industry and there can be follow-on work then to take those numbers and look at in more detail how an instrument may, in fact, be affected in those environments.

So there's still on-going work with DOE. EPRI, there was past studies they had done in this area, looking at instrumentation needs for post-accident, severe accident back in the '90s. And they also have a working group that's currently under way. We're participating in that. That's looking at new severe accident instrumentation needs coming out of the Fukushima event.

So at this time I want to turn it over to -- we're going to have a number of slides that talk about things we did under the task 3 which is part of our analysis and ultimately part of our determination of where we're going with recommendations for either additional regulatory requirements or additional guidance. But first Joe is going to touch base on some of the key interfaces

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we had with some of the higher level Tier 1 items and how they impacted us.

SUBCOMMITTEE CHAIR SCHULTZ: Before we go there, Russ, so what I've seen in task 2 and you wanted to describe it quickly, but there was a lot of meat to it, in that you were identifying a number of features or tasks that have been accomplished and will go forward to continue to establish both needs and expectations associated with instrumentation that would survive severe accident conditions and be codified in these guidance documents, international and domestic. That's what I'm hearing.

Charlie?

MEMBER BROWN: You said survive severe -- my button is pushed -- survive accident conditions. And I guess when I looked at this, I didn't see based on your conclusions, I don't want to leap to the end here, that there was not the point it was assessing what they had not necessarily instrumentation that would survive beyond design basis events or severe accident conditions. Now that was my reading. If you're going to tell us what you're going is something different, that's just fine. But that was not the way I read the entire layout plus the other pieces of paper.

SUBCOMMITTEE CHAIR SCHULTZ: I thought from what was described here there are a couple of different aspects. One is these investigations that are drawing the conclusions that instrumentation capability needs to be improved and it's being codified internationally in the IEEE documentation. Is that not the task 2 result?

MR. SYDNOR: There's a lot of different results in task 2.

SUBCOMMITTEE CHAIR SCHULTZ: Okay.

MR. SYDNOR: Certainly, internationally the IAEA technical document doesn't draw conclusions for people. It presents a process for how you would do the entire analysis. I'll actually get into that in more detail on a later slide if you want to wait for that one.

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The IEEE is heavily influenced by what the IAEA developed and they're putting out requirements, but its new IEEE standard, so even our endorsement of it is looking forward. It wouldn't be -- it wouldn't be regulatory enforced on operating plants just voluntarily. A similar way, SAMGs are going to be applied to the operating plant.

Well, when we put this guidance out there it would help if an operating plant chose to use it as a means to trying to do a better job of examining instrumentation because it doesn't just look at new instrumentation. It looks at portable instrumentation requirements, different strategies whether you're using it for mitigation or prevention, things like that. So it's not a one-shop --

MEMBER BROWN: But the point is it's not even part of a reg. guide of any kind.

MR. SYDNOR: Not yet. We'll talk about that.

MEMBER BROWN: We're talking next year.

MR. SYDNOR: It's not that far off that we would endorse --

MEMBER BROWN: Yes, but what reg. guide are you going to get it into? My point being is that even if you look at it from -- if you look at it separated into operating plants today and new plants, there's a difference. And I know you're going to talk about the difference between the two, but the idea of any requirements per se that people have to do for reactor instrumentation for severe accident that is totally voluntary if they so desire. And even in the reg. guide because it's a new reg. guide would not necessarily be part and parcel with any licensing basis or any other type of requirements that they have to follow. It's just there if they decide to do something.

MR. SYDNOR: That's correct.

MEMBER BROWN: That's my understanding.

MR. SYDNOR: That's correct.

MR. G. BOWMAN: Joe will talk a little more about our basis for that, but we

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have concluded that there is not sufficient basis for us to backfit --

MEMBER BROWN: I understand. I'm just trying to make sure Steve -- he didn't get a yes or no and I'm just trying to put it into some type of context so that you would understand what they're doing and that the discussion was useful.

SUBCOMMITTEE CHAIR SCHULTZ: No, I understand that. Thank you.

MR. SEBROWSKY: So as Russ discussed and also Greg alluded to, one of the things that we did as far as task 3 is looking at the task 1 results to see any influence that it would have on requiring, and that's a key term, requiring licensees to enhance their instrumentation. And as you indicated, we found that we could not require operating reactor licensees to enhance their instrumentation. So what Russ is going to talk about is a voluntary --

ACRS CHAIR STETKAR: Joe, this goes back to what we were talking about this morning though. And I'm starting to really regret the fact that I voted on the ACRS letter saying that there should not be rulemaking to require SAMGs because I now see that the staff is using that very narrow legal distinction as justifying not doing things that seem to make sense technically.

Everybody agrees that SAMGs are a good thing. Nobody said that you should not have SAMGs. The industry thinks that SAMGs are a good thing. The industry is going forward with having SAMGs. The ACRS, in our April 22, 2015 letter, clearly said that SAMGs improve safety of nuclear power plants, despite the fact that we may not have the tools to quantify that improvement on a plant-by-plant basis. We are on record as ACRS for saying that.

If everybody agrees that SAMGs are a good thing, then why do we just dispense with the notion that we need instrumentation to support those SAMGs, simply because some legal people said we don't want to go through the harangue and cost of promulgating rulemaking to require SAMGs by law. You're now using that legal argument to say that the operators don't need to have the instrumentation that they need to follow the procedures. I don't get it. Because that's the

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notion that I got from reading your conclusions.

MR. SEBROWSKY: I understand. I'll try to respond to your question, and Greg and Jeremy can interject, and we have the rulemaking folks that were involved with the development of the proposed rule in April.

ACRS CHAIR STETKAR: I don't want to talk about rulemaking because lawyers talk about rulemaking. I want to talk about operators in nuclear power plants trying to mitigate the effects of a severe accident using procedures that everybody agrees is a good thing.

MR. SEBROWSKY: Yes. So there is not an argument in the paper that SAMGs aren't a good thing or are not important. And as a matter of fact, if you look at the SRM from the Commission, although it rejected the legal argument for requiring SAMGs, it still said there were two things in there in SAMGs. Still said they were a good thing, that we expect -- we expect licensees to voluntarily implement SAMGs and we expect you, the NRC, to upgrade the ROP to look at that aspect.

And then you also see in that same SRM a discussion that the Commission directs that the SAMGs would be integrated with the EOPs, the flex support guidelines and the extensive damage mitigation guidelines that you saw from the security aspect.

SUBCOMMITTEE CHAIR SCHULTZ: One way to look at that direction is that from the committee's viewpoint is that's just what we wanted. We wanted that statement to be made that it should be integrated, that it should be fully developed so on and so forth. It was something of what I hear you're saying, but we want to be sure that that, in fact, happens in integration and making it work and having it available includes the instrumentation piece of it.

MR. SEBROWSKY: But that does not mean -- don't misconstrue that this means the work is stopping on SAMGs. It's not. Clearly the Commission directed --

SUBCOMMITTEE CHAIR SCHULTZ: We want to be sure that statements aren't made would detract from that.

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MR. SEBROWSKY: Well, the importance -- there is a very important distinction here. And you saw arguments this morning where one of the things that we looked at is do we have -- doesn't meet the threshold to require enhancements to instrumentation, right? That is what the staff was looking at. And requirements can be implemented through -- it's not just rulemaking. If we saw an issue that was an immediate safety concern, we go through orders or other mechanisms to immediately address that.

And all this slide is meant to -- the point that this slide is meant to make is when you look at that aspect, do we have a basis for requiring licensees to enhance their instrumentation to survive severe accident either through an order or through rulemaking? We do not see a regulatory basis for requiring licensees to do that. It doesn't mean that we don't think it's a good idea. It just means it doesn't meet the threshold when you look at the analysis that was provided, a regulatory analysis that went with the proposed rule, it went through an argument that essentially said when you look at SAMGs, they do not meet the quantitative health objectives.

MEMBER BLEY: Let me ask you a question. If, in fact, we're going to build examination of the SAMGs into the reactor oversight process, what's an inspector to make of not having instruments to allow using the SAMGs?

MR. SEBROWSKY: If you look at the SAMGs, the way they are written, and I understand the question, but if you look at the SAMGs the way they are written, there's a multi-step process. You use the instrumentation that's available, primary instrumentation that the SAMGs rely on. If that's not available, then you go to alternate instrumentation. If you have pumps running you can use the discharge pressure of the pump. If that's not available, you go to calculational methods.

There are documents that back up the SAMGs that, for example, look at the core exit thermocouples and the dry well radiation levels to do an indirect assessment of what your core conditions are and how much are you cooling the core or not indirectly. So there are steps within

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the SAMGs that take advantage of that sequence of events.

MEMBER BLEY: Let me just toss two things out. One is a question. One is a comment. As long as they give you ways to work backwards that at least gives me a little more comfort. If we look at pump discharge pressure, that's a little troublesome because I can show you a lot of events in nuclear power plants and in chemical plants at other places where with full discharge pressure no water or other fluid is getting to where you want it.

My question is you have a table in Enclosure 5 that says consistent with other guidelines in the SAMGs, here are the typical parameters that you would use during a situation like this. And I was kind of surprised that -- and maybe SAMGs are like this, for PWRs there is no reactor level -- reactor vessel level indication and after TMI people went to all kind of trouble to put RVLIS systems in their plants. I was kind of surprised that wasn't on the list.

MR. SEBROWSKY: We'll go through the first bullet here because I think the table that you're talking about gets to the MBDBE order. But go ahead.

MEMBER BROWN: I wanted to comment on Dennis' point when you talk about alternate means and/or calculational means, if you get into these calculational means, I guess a recent INO report noted that as other reports have noted for TMI, this is PWR TMI stuff, that the actions of the operators to mitigate, to even prevent some of the more severe circumstances they did the wrong things and adversely contributed to having the accident get worse as opposed to get better, to resolve it.

Calculational is nice if you want to look at something after you've kind of settled out, but how you do that in real time when somebody is trying to say what do I do now? Okay, what do I read? Where's the pressure? Where's the temperature? Where's the level? Where's whatever? How -- those are calculational and some of these backups are not necessarily useful for that on-the-spot type stuff or -- I mean how do you get through that without some way of knowing or

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some relatively resilient instrumentation that tells you the critical parameters, to give you some ballpark about where you are.

MR. G. BOWMAN: With respect to your question, the table in the paper is not -- that's not severe accident instrumentation. That's instrumentation that supports the mitigation of beyond design basis events or BDBE, mitigating strategies order. So just to clarify that --

MEMBER BLEY: But the words where they'd say "or within the SAMGs" --

MR. SEBROWSKY: Let's back up to make sure I understand -- I'm getting multiple questions here. To address the table and Greg's point, one of the points that we make again, this is going back to looking at the results of the Tier 1 activities and how it impacted our review. If you look at the second bullet here, we talk about the MBDBE order. And this is -- we're trying to make a very simple point here. And the point that we're trying to make is the MBDBE order has a very limited set of instrumentation that is expected to continue to be powered to demonstrate the success of the mitigating strategies that are used.

So what you see in that table is something that was extracted from the guidance that goes with the order. And the reason it says SAMGs is the key instrumentation that you look at for PWRs in that table in the NEI-1202, what you're doing in mitigating strategies is you're trying to preserve battery power. So you don't want to take instrumentation away from operators unless you absolutely have to during an extended loss of AC power. And if you're going to take instrumentation away, take the instrumentation away that you don't need to assess whether or not the mitigating strategies has worked.

So the key instrumentation for the PWR, if you look at that instrumentation, it's a typical PWR, you're trying to remove decay heat through the steam generators. So you're looking for steam generator level, reactor pressure vessel level. If you look at the BWRs, you're trying to remove decay heat through RCIC. So that's the kind of instrumentation you're looking at.

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If you look at how that gets promulgated to new reactors for the AP1000, for example, they rely on passive residual heat removal heat exchangers, but the instrumentation is associated with whether or not that's working. If you look at the ESBWR, the instrumentation associated with that is associated with the isolation condenser.

It's very limited, but what the order attempts to do recognizing that there's different scenarios that get you into a severe accident, what the order attempts to do is to address the extended loss of AC power scenario that gets you into a severe accident --

MEMBER BLEY: I was waiting for that because we've been talking for several years about this. We focus so much on that particular event. It wasn't a big problem for Fukushima, but now we're moving to where we're going from here. And what you just said is very important. There are many different kinds of accidents and can get you there, and having a focus on the extended loss of AC power without the consideration of the others I think we ought to be beyond.

MR. SEBROWSKY: And I believe we are. The point -- the only point that we were trying to make with what the MBDBE order, it helps you out with one of the severe accident scenarios with the extended loss of AC power. And it provides a means to inform the operators that yes, the mitigating strategy is success or it's not, core damage is imminent or it's occurring.

If you look at Reg. Guide 197 that Russ alluded to and you look at what happened after TMI, you see instrumentation that's very important including radiation monitors and containment that help with assessments.

You also see with things like what was done for new reactors that it's not just limited to this small set of instrumentation. So the only thing that that table was meant to do was to say look, we looked at the Tier 1 activities. Was there anything done in Tier 1 that affected our assessment and we believe that the scenario that you saw at Fukushima 1 and 2 where the lights went off, they lost instrumentation, power comes back on. They didn't recognize that they were getting

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erroneous readings. Had they seen that the core was degrading that they indeed mark removing decay heat they perhaps would have come to a different conclusion. So it's only for that sequence that that's helpful.

I was trying to address the table. Now I think I've got to go back to Mr. Brown's question. Did I address the question about the table?

ACRS CHAIR STETKAR: You did, but one can read the text a little differently than the way you just presented it.

The problem with this, Joe, is that what you talk about orally in this meeting is not in my mind consistent with what is written in the text.

MR. SEBROWSKY: I understand.

ACRS CHAIR STETKAR: As someone who was not involved in writing it as a commissioner or a member of the public, the impression that I was given reading the text is that yes, indeed, the Tier 1 activities will provide assurance that under degrading plant conditions we have power available to instrumentation that's qualified for operation before core damage occurs and to make sure that that instrumentation is available as long as we can maintain it, but after core damage occurs, we basically give up and say we don't have any instrumentation. Because all of the MBDBE stuff, all of the flex stuff is designed to prevent core damage. We're talking about instrumentation that survives core damage and provides operators information for mitigating the effects of severe accidents not event scenarios that may eventually result in a severe accident.

MR. SEBROWSKY: I understand.

ACRS CHAIR STETKAR: So the argument is about Tier 1 and maintaining power supplies to instruments and what complement of instruments do I need to have steam generator levels and pressures and aux. feedwater flow and whatever the heck it is all prevention to core damage. It has nothing to do with a severe accident.

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MR. SEBROWSKY: I understand.

ACRS CHAIR STETKAR: It tells you that you might be on a trajectory that suddenly the world is going to turn very bad for you and at that point you're left with gee, now what do I know?

MR. G. BOWMAN: We can go back and look at the paper. The intent is -- what we meant was exactly what Joe described that the mitigating strategies, equipment, provide some continuity from the time the event takes place until you get to core damage as an aid to the operators.

So --

ACRS CHAIR STETKAR: Okay, but what happens after core damage?

MR. G. BOWMAN: That's what we're going to talk about.

ACRS CHAIR STETKAR: Let me come back to the slide you still have up there though because again reading what's in the words and I wanted to get this on record to reemphasize it, in the text and what kind of set me off, if I just read the text and of course, I've lost it, so bear with me so I can find it again.

SUBCOMMITTEE CHAIR SCHULTZ: You're talking about the enclosure 5 text, right?

ACRS CHAIR STETKAR: It's enclosure 5, it's on page 11. It says under quantified risk information, "The analysis concludes that SAMGs would have a small safety benefit that would not significantly help plants maintain the margins for QHO. The conclusion is based on the risk of a severe accident being well under the existing emergency preparedness requirements and show that the surrounding population is adequately protected in the unlikely event a severe accident occurs. The staff notes that given that SAMGs could not be justified based on quantified risk information alone, the position of enhanced reactor and containment instrumentation requirements to further improve SAMGs are similarly not justified based on risk." Hence, your first set of bullets on

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this slide.

We, in our ACRS letter, noted that the quantification that's referred to here was strictly a very limited assessment that was done for the CPRR rulemaking that looked only at justification of filtered vents for BWR Mark I and Mark II containments. That's true. Bill can come up and try to dispute that. I don't think he will.

So I'm left even for the entire fleet of BWRs, much less PWRs, how one can justify quantitatively that the benefits of SAMGs are not justified. The fact of the matter is you can't because neither the staff nor in large part the industry has the quantitative tools, the Level 2 PRA models that can actually measure that difference, what would the off-site risk be given SAMGs or not having SAMGs? But relying on that very, very focused application to examine whether or not filtered vents can be justified for BWRs with Mark I and II containments and then expanding this to a conclusion that you don't need instrumentation to support SAMGs is in my mind a real stretch.

MR. G. BOWMAN: If I could just make a point. The first point is --

ACRS CHAIR STETKAR: That's what I read from the --

MR. G. BOWMAN: This is a Group 2 recommendation, so it's one that we're planning on coming back to you to discuss in more detail.

ACRS CHAIR STETKAR: It is a Group 2. It's not a Group 3.

MR. G. BOWMAN: The other thing, the staff's recommendation was that SAMGs be made a regulatory requirement, right? That was what we proposed to the Commission and that was not approved. So we put forward the argument that you're making, but you didn't win the day. So that's what we're left with when we assess this recommendation is that the SAMGs themselves cannot be justified as a regulatory requirement.

ACRS CHAIR STETKAR: It can't be justified by lawyers and accountants who look at the practical considerations of the effort that it takes to promulgate rulemaking.

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MR. G. BOWMAN: I don't agree with your characterization of the people who prepare the rule. I mean we have engineers work on this rule. It's not lawyers and Tim Reed is back giving thumbs up.

ACRS CHAIR STETKAR: I'll come back to the conclusion that the ACRS reached was that everyone seems to agree that SAMGs are a good thing to have and that there is a safety benefit from having SAMGs. I think that many people will acknowledge the fact that it is extremely difficult in a quantitative sense given the tools that we have available today. The lack of fully integrated detailed level 2 risk models for three of the plants, that it's very difficult to quantify the potential benefits on a plant-specific basis or across the industry. We just simply can't do that. I wish we could, but we can't.

And based on that, and then I'll come back to my accountants and lawyers, the practical decision was made given the fact that everyone agrees that SAMGs are beneficial and that the industry is going ahead and promulgating them. The Commission said make sure they're integrated. The Commission didn't say do away with them. They said make sure they're integrated. And the ACRS said make darn sure that the regulatory oversight process keeps an eye on them to make sure that they are integrated, that they're kept up to date, that there's training and that all of the necessary equipment is available.

And with that, I don't get the notion, I just don't understand this notion that we don't need instrumentation to support them.

MR. G. BOWMAN: I don't think we're saying that. I think we're saying --

ACRS CHAIR STETKAR: Well, that's --

MR. G. BOWMAN: So the SAMGs are being initiated on a voluntary basis, based on the Commission's direction. What Russ is going to talk about is a voluntary initiative we're working on to endorse an IEEE standard that would give the industry guidance on severe accident

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instrumentation. So we're doing an analogous, taking an analogous approach to instrumentation in my opinion.

And Russ, maybe you could disagree or what --

MR. SEBROWSKY: But it's disingenuous to suggest that what we document in our evaluation is -- and if the ACRS sees a way of requiring licensees to upgrade their instrumentation when SAMGs are not required per Commission direction that would be helpful. But the argument is that the Commission clearly -- we clearly said we believe SAMGs should be a requirement. The Commission did not approve that position.

MEMBER BROWN: Yes, but even in proposing that, say they had agreed to proposing that as a rule under the rule, you still did not have -- that did not embody requirements to upgrade instrumentation. It only talked about methods and processes and procedures to mitigate, but it didn't say anything at all relative to instrumentation to actually know what you're doing and what you're responding to.

MR. SEBROWSKY: That's correct. If you look at what's in the April 30th proposed rule that was sent to the Commission, that the Commission voted on it argues from a defense-in-depth perspective for SAMGs, but it also has a discussion in there about instrumentation and why the staff's analysis concluded that instrumentation enhancements were not required.

MEMBER BROWN: Exactly which is counter intuitive to some of us.

ACRS CHAIR STETKAR: Let me try something else if I can. We are at a woeful disadvantage because we don't see a lot of things. In particular, I'm not aware that any of us have seen the upgraded SAMGs that people are working on currently. So, for example, when you refer to the fact that the normal instrumentation might not be available and might not be reliable, that the operators may have alternate ways of determining and in fact, they are at least providing water to quench core debris or something like that or that there may be some sort of ad hoc calculation methods that people

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could use. I'd really be interested to see how the SAMGs work that out, actual SAMGs for real plants, not sort of conceptual ideas.

Is there some way that we could get to see an example of the SAMGs for two or three different reactor types, large dry, ice condenser, one or two boilers or something, to see how they do that? Because that might give us some confidence that even if we don't have a requirement for upgraded instrumentation and even if the licensees don't see fit to upgrade the instrumentation that indeed there is a reasonable path forward to support the operator.

MEMBER BLEY: We've got access to a library of DOPs, SAMGs that were catalogued for the Emergency Response Center. I might look back at that on a couple of years, so they might be in there at this point.

MR. SYDNOR: The old ones are in there.

MEMBER BLEY: The old ones are there. Nobody has developed the new ones.

MR. SYDNOR: We reviewed the owners' groups of guidelines for how to develop them. Those are available.

ACRS CHAIR STETKAR: Is that the EPRI report?

MR. SYDNOR: No these are PWR --

ACRS CHAIR STETKAR: I haven't seen those.

MR. SYDNOR: They aren't publicly available. There's a special site you have to get access to.

ACRS CHAIR STETKAR: You see what I'm asking. Something that could give us confidence that even --

MR. SYDNOR: -- how they'd be used.

ACRS CHAIR STETKAR: Even if nobody does anything regarding instrumentation, other than complying with the Tier 1 orders for extending power and identifying

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minimal complement of instrumentation to get people information that they need to either cool the core or see what trajectory they're on that once core damage occurs that the guidance provides the operators -- in the worst case scenario meaning the industry doesn't do anything voluntarily to upgrade instrumentation that the operators have a chance to know what might be going on.

MR. G. BOWMAN: We understand the request. We'll take that back.

MR. SEBROWSKY: Just to make sure, to clarify, the SAMGs, as a result of Fukushima and implementing flex are being upgraded by utilities. We can't -- I mean that's happening and my understanding is that's going to be a couple of years away.

MR. G. BOWMAN: So let us go back and think about how we can --

MR. SEBROWSKY: Well, but I mean there are statements in here that --

MR. G. BOWMAN: I understand.

MR. SEBROWSKY: -- that lead me to believe --

MR. G. BOWMAN: -- yes --

MR. SEBROWSKY: -- that I was sort of asking about, so there must be some knowledge. I just don't know. The fact that they're not developed, the actual plant-specific procedure --

MR. G. BOWMAN: The current SAMGs should actually be able to accomplish the same thing. Let us just take that as an action and we'll get back to you.

ACRS CHAIR STETKAR: Thanks.

SUBCOMMITTEE CHAIR SCHULTZ: I want to emphasize again that just in order to leave what I think is the appropriate presentation of this. If this were a slide that I was preparing, given the discussion that we have just had particularly, I would have a second bullet here after the presentation that the Commission has approved as a requirement and so on and so forth. Those are the rationale. But there ought to be a second bullet that describes the SRM, the Staff

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Requirements Memorandum, associated with SAMGs that in spite of bullet one, SAMGs are being implemented because industry said they would implement them. And the Commission recognizes that is a whole program that is behind the SAMGs and that that program will be implemented in such fashion that severe accident mitigating guidelines will be not only implemented, but supported and as we've said already supported by the instrumentation or the process that is required to assure that accidents are mitigated -- severe accidents are mitigated.

So I think that needs to be described carefully so it doesn't leave the impression that we can't find a reason for a regulatory requirement or so nothing is going to be done. There's a substantial statement by the Commissioners that that program is moving forward, so therefore, we're in a good place with regard to that instrumentation. Tim?

MR. REED: I'm Tim Reed. I'm the project manager for the mitigation of the beyond design basis events rulemaking. It's nice to talk to you all again.

The SAMGs, I wanted to clear up a little bit, the SAMGs are in place and have been in place at all sites since 1998, so that's the first thing they are in place. They have been in place as you well know. And basically, I think it's the May 11th letter, the NEI letter that's referring to recently. It has recommitted to upgrade those, okay? So that's ongoing and you're correct, there are significant enhancements, five additional candidate high level actions all -- Fukushima being built into the SAMGs.

A lot of work is going on, but I wanted to make sure there's some sort of almost an impression that they're going to implement. They're already implemented. They're being upgraded and we're going to hold them to that commitment. We're going to work on that, of course. You guys have encouraged us to and in fact, we're doing that and that's going to be in the revised FRN. We're holding them to that commitment. Okay, I just want to make sure that was understood.

ACRS CHAIR STETKAR: I think we understand that, Tim. I just didn't know in

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terms of that transition from the existing SAMGs because we're not familiar with the existing SAMGs either, whether additional considerations were being given -- you know, in light of Fukushima to considerations of the operators implementing the updated SAMGs under conditions where they didn't have any reliable or very, very limited instrumentation.

MR. E. BOWMAN: If I could add to what Tim had to say, this is Eric Bowman. I'm one of the special advisors in Japan Lessons Learned Division. The current implementation of the SAMGs by the industry which was done in 1998 was in response to commitments that they made to follow the guidelines in NEI-9104 Section 5 which included the four elements for the instrumentation toward the means to get alternate instrumentation or calculational methods to estimate what plant conditions are. They were in the NEI-9104 and they were accepted by the Commission. I don't recall what the SECY paper was and the SRM on it was, but this particular policy issue did go to the Commission and NEI-9104 was accepted as an appropriate method of resolving severe accident issue in 1996 or so.

MR. REED: You're testing my memory. I know they have tried that, upgrade that. In fact, I think they've been in and talked to you a little bit about their efforts to maybe trend more for instrumentation. I think they've done that with you folks. They are trying to build some of that instrumentation aspect to the SAMGs, but in fact, the SAMGs were built around the fact that you're going to get -- if you lose instrumentation, it's going to get erroneous. You're going to have to go to alternate instrumentation. You have to go to calculational methods. Best to build in SAMGs from day one. Of course, they're trying to run more, I'm sure you're well aware of from Fukushima to make that even better, but that's been a part of it.

I think it would be very helpful for your folks to perhaps have the industry come in and present that to you because really this is the industry presenting it to you. It is a voluntary admission. I think it makes more sense. In fact, if that's the way the chairman or Mr. Stetkar, that's the

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way to get a better feeling about it.

ACRS CHAIR STETKAR: I personally would appreciate that. Again, I know the industry, in particular, EPRI in 2012 published a faded guidance for SAMGs, technical basis. My problem is I don't know the whole history of the SAMGs to know how that technical basis which I will admit I have not read cover to cover has changed any of the thinking regarding instrumentation or alternative methods to understand what's happened. I just don't know.

MR. REED: Actually, I'm not a lawyer. I am the author of the analysis, but I do have kind of a history of the SAMGs and the NRC. If you go into Appendix A of the reg. analysis that supported the draft rule, okay, and you look in there, you'll see a -- I tried to go through a history because I thought it was very important for the Commission to understand the history of this issue because they, in fact, have debated on it before. So I tried to hit the highlights there so you could find some of that there.

ACRS CHAIR STETKAR: That I did read, Tim. Thanks.

MR. REED: Okay.

MEMBER POWERS: I had a couple of points in this protracted discussion. You complained about the inadequacy of the computational tools available to the staff. I understand better what the --

ACRS CHAIR STETKAR: No, I don't even know what those tools are.

MEMBER POWERS: You were referring in the definitive in your assertion that they did not have tools capable of measuring the effect of SAMGs.

ACRS CHAIR STETKAR: No, that's not the -- the statement says that in the SAMGs, the operators are led to a point where if you don't have any instrumentation available, there are alternate computational tools that you can use, now in real time to determine --

MEMBER POWERS: And that is an actual statement.

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ACRS CHAIR STETKAR: Okay. I don't know what those are though. I mean if you're talking about running MELCOR and things like that.

MEMBER POWERS: I think the licensee uses something quite different than that.

ACRS CHAIR STETKAR: Well, that's what I was asking is what do they have and who does that?

MEMBER POWERS: Well, and they can get broad outlines. I mean one presumes that for a symptom based SAMGs set, back of the envelope calculation worked quite well.

ACRS CHAIR STETKAR: The problem is that one can presume a lot of things. I haven't seen the SAMGs to see how they provide the guidance for the operators or the technical supports center staff or whoever is trying to work through this process to say what do you use under particular conditions.

MEMBER POWERS: What I can --

ACRS CHAIR STETKAR: When you give up on the instrumentation you have because it's not reliable enough, when do you not trust the instrumentation that you have that you're not sure whether it's reliable enough and you need to run some back of the envelope calculations.

MEMBER POWERS: What I do know as an absolute fact, decision makers in connection to the Fukushima reactor were using a lot of ad hoc calculations in order to do just what you're saying to understand in the absence in their case of any kind of instrumentation at all. I can understand what effect various actions might have. Those are useful. What we have available now to not so much operators, but technical support center personnel is substantially more sophisticated than that. I can't speak to the issue of what priorities refinement and improvement of that is --

ACRS CHAIR STETKAR: That's essentially what I was asking for is to see --

MEMBER POWERS: And I also know it also gets attention when you're up at --

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also to have things for quick -- not 24 hour running -- what I tend to call calculational aids that are at least as faithful as you can for a simplified code to what understanding we have severe accidents. Those surely exist and you can draw upon them and we should draw upon them, but to formulate things that are what I would call symptom-based rather than --

ACRS CHAIR STETKAR: I'm not arguing with that. I think that if I better understood how the guidance is pointing people to use those tools and under what conditions it sort of indicating you better start thinking about using those tools, that would provide me a lot, personally a lot better confidence in terms of saying well, maybe we don't need instrumentation that can survive or potential core damage conditions.

MEMBER POWERS: Perhaps a discussion off line, a narrative, but I certainly thing that strategies for instrumentation under severe accident conditions I've seen are just completely on the wrong path. I spent a lot of time working in severe accidents and they're formidable environments.

ACRS CHAIR STETKAR: Yes, yes.

MEMBER POWERS: But there are alternatives. There are alternative approaches that don't have to confront that environment and I'm distressed that they're not being pursued more aggressively.

ACRS CHAIR STETKAR: I think offline discussions are good, but that other issue that points to is it worth pursuing, what has been alluded to in terms of IEEE requirements for instrumentation and IAEA guidance in terms of severe accident capable instrumentation in a broader sense. But that's, as you said, that's kind of an offline peripheral discussion.

ACRS CHAIR STETKAR: Ed?

MR. FULLER: Yes, this is Ed Fuller from the Office of Research. To answer John's question from a few minutes ago, the calculational aids are basically based on the EPRI

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Technical Basis Report and in the various SAMGs you will find figures and tables to allow you to infer where you might be if you don't have instruments. And so it's not just vendor specific, but actually probably gets down to the plant specific details on what to look for if you don't have the instruments.

MEMBER BLEY: Ed, I haven't looked at the SAMGs or the new basis document in a while. If one were trying to use them, do you need both your own SAMGs and the technical basis document to reinforce what you're doing?

MR. FULLER: I would assume that the people in the Tech Support Center would be sufficiently well versed in the EPRI Technical Basis Report but they wouldn't have to be going through the many, many pages of the phenomenology part of the report to get at those -- the bases for the calculational aids.

In my opinion, the TSC people really need to be well trained on this going in.

MEMBER BLEY: I don't know that we have --

SUBCOMMITTEE CHAIR SCHULTZ: I think the committee would benefit based upon the question to benefit from a discussion with the owners' groups. And EPRI is the technical support to the owners' groups' activities. And also some licensees, a few licensees that have been through the implementation because they do need to be translated into plant specific technical support center methods and procedures and they are -- those calculational procedures are in place and they generally have been tailored by the Technical Support Center staff to ensure that in the event of an accident they're ready to be used. There's not a calculation that needs to be done, rather there's a calculational process to be implemented that's ready to go. I think the committee would benefit from hearing about that in more detail.

MR. BOWMAN: Well, Steve, we've gotten pretty far behind. How do you want us to --

SUBCOMMITTEE CHAIR SCHULTZ: Proceed.

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MR. SEBROWSKY: So this is a continuation of the Task 3 results and taking a look at the Tier 1 activities and any influence that they would have on the staff's evaluation of the enhanced instrumentation. And this slide is just meant to show that both the spent fuel pool or for all operating reactors and then the containment vent order for Mark I and II. Containment BWR reactors include guidance and expectations for instrumentation that it will work in the temperature radiation and humidity levels expected during the time the instrumentation is needed. You find those expectations for the spent fuel pool order in NEI- 1202 and for the containment vent order you see that in NEI-1302, Rev. 1.

So I'll turn the continuation of what we did in Task 3 over the Russ.

MR. SYDNOR: We looked at information that we derived from our collaborations and participation in international management studies and one of the key document we looked at was the IEA technical document report on accident monitoring systems. And this is a very comprehensive report. It covers the full scope of design considerations that aid in the development of adequate accident monitoring capability. It covers a range of accident conditions. It discusses the evolution from design basis to beyond-design-basis, which they came up with a new designation called design extension conditions and those being beyond-design-basis but not severe core damage to severe accidents that are, obviously,

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beyond-design-basis and severe core damage.

So the process outlined in this document supports preventative and mitigative strategies, provides the design criteria for permanently installed as well as portable instruments and provides guidance for qualification and survivability considerations. So, it is very comprehensive.

One of the primary influences that benefits us is that the loop for the IEEE standard work group participated in that working group with the IEA. And so that had a heavy influence on this next rev of the IEEE standard.

Before I go to the IEEE standard, I will just mention that one of the annexes, there is two kinds of example annexes in the IEA report. One of them is essentially a summary of the Japanese, which some of you may have heard, SA-Keisou. It was really research and development planned but ultimately, they looked at severe accident instrument requirements, they looked at survivability and then they actually proposed research and development to try to develop enhanced instrumentation in some cases, in some specific

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cases.

So, in our use of that work, we kind of used that as almost a benchmark for a standard so when we compared one of the mitigating strategies for instrumentation what are the SAMGs suggesting, what are the owners groups suggesting as part of their efforts? We used that as kind of a benchmark comparison standard.

And so I just wanted to mention that because we used that as a key part of our evaluation to understand the difference between what the U.S. industry is proposing, which is a step-by-step kind of adaptive mitigating strategy approach, whereas the Japanese approach, if they fully implement, is more of a traditional design approach like a design basis. It essentially analyzes severe accidents, develop the conditions, and design conditions, and then actually proposing doing the R&D work to develop the new instrumentation. So of anybody we looked at, that was probably the extreme case of going that far but it offers some good information and it is a good benchmark for the industry.

The IEEE standard picked up on the work

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of the IEA and they are developing a new standard. A new division is going to add severe accident instrumentation criteria. It is going to adopt the IEA definitions, including this design extension condition definition. It has consideration for coordination of instrumentation with SAMGs, consideration for environmental conditions of the instrument performance and considerations on the use of portable instruments. So, it has got a lot of good useful guidance or will have, once it is published.

So, what we propose to do as part of our -- one of the outcomes of our two or three items is that we have already started looking at an update to Reg Guide 197, based on the planned update to the IEEE standard.

The current, the IEEE standard has already been balloted, already been voted on by IEEE members so it is past that hurdle. It is final comment resolution and, if it goes through the remaining approval hurdles, towards the end of the year we hope to see an actual published new revision by early 2016.

ACRS CHAIR STETKAR: Oh, so this is

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reasonably near-term.

MR. SYDNOR: Reasonably. We already have a copy of essentially close to the final version.

ACRS CHAIR STETKAR: You are talking about sometime --

MR. SYDNOR: Early 2016 is what the projection is.

ACRS CHAIR STETKAR: But in terms of the update to the Reg Guide, sometime in --

MR. SYDNOR: We could probably achieve that by the end of 2016, depending on when we get the final. And obviously, the committee sees those as part of the Reg Guide update process.

ACRS CHAIR STETKAR: Yes.

MR. SYDNOR: So, that is one of the concrete things we get that came out of the plan.

So, this guidance can be used as part of the discussion we were having earlier, voluntary standards, but in some of our work, specifically with the EPRI working group, two of the members of that team are the same people who are leading the owners group SAMG efforts. So, we have had a lot of feedback from them on things they are doing.

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They are doing a lot of good things, including developing and adding MELCOR to plant simulators or purchasing an entire simulation capability for severe accident. They are testing and they want to test operational aids, how the operators can use those. They want to test predictability of when instruments will no longer be functioning. The industry is doing some good things. I really think it is a good idea to have them come in and talk about this.

I don't have a lot of data points but the data points I have are encouraging.

The final thing that we did, and really with no new recommendation here is since we are saying that the new reactor policy for severe accidents and the regulatory treatment of that that is currently ongoing, we have no changes to that. In fact, we primarily used it as kind of a learning aid to understand what new reactors are doing that is different than operating reactors. And early on, the thinking that some of that could influence whatever we proposed for rulemaking for operating reactors.

We also just noted here that the

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mitigating strategies requirements are enforced for the new reactors, the licensed new reactors, too. So, their treatment of severe accident instrumentation is, I will just say that we reviewed some of their Chapter 19 work and there is actually significant detail in there about identification of the instrumentation, how they are analyzing it for survival bury, and that has been reviewed by the staff and accepted. We are not recommending any changes to that.

And Joe is just going to close out our discussion.

MR. SEBROWSKY: So, in conclusion, if you look at the bullets on the slide, we have covered the majority of them, except the initial conclusion is that there is limited additional safety benefit. That is what you will see or that is what is proposed in the assessment that is to be issued by the end of October. And that the staff could not identify further regulatory action was needed.

And the final assessment that is scheduled in March of 2016 will add input from these here external stakeholders. That is the plan

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right now.

That ends this portion of the presentation.

SUBCOMMITTEE CHAIR SCHULTZ: Just a question. The choice of the words limited additional safety benefit is that selected for the slide or is that a terminology that has been determined appropriate? I understand there is not a significant safety benefit to be achieved.

MR. BOWMAN: I think those are the words -- the words we used in the paper are substantial safety benefit, I believe. There is no substantial safety benefit so we used the words more from -- I take it back. Well, I don't know that we used those words.

SUBCOMMITTEE CHAIR SCHULTZ: That sounds better to me.

MR. BOWMAN: If there are no questions, Joe, we are on slide 49 now.

So the two recommendations we will discuss next were generated by the staff, so they did not come from the Near Term Task Force or other stakeholders. They would have us reassess the emergency planning zone size and practices

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associated with pre-staging potassium iodide, based on the insights from the accident.

The initial plan that we put together, if you recall, at the beginning of the presentation, I discussed that we put together plans years ago, the initial plan in SECY-12-0095 would have us weight some longer term health effects studies from Fukushima before moving forward with these recommendations. Health effect studies will be going on around Fukushima for many, many years but we do have some international reports available to us now; one from the United Nations and one from the World Health Organization. And so we believe it is appropriate to move forward with these two recommendations now, based on that information.

Next slide, Joe.

So, our basis -- we are going to recommend closing these two recommendations. Our basis draws heavily on a 2014 petition for rulemaking denial that we issued on the same topic. And that provided the staff's basis for why we think EPZ size is appropriate, which the Commission subsequently approved.

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The paper that we are going to send up in October, we will pull from that, like I said, and it will discuss the initial basis for the current EPZ requirements in NUREG-0396. It will discuss a number of studies that were completed after that NUREG to validate our current practices. It will talk about lessons learned from some large-scale evacuations, primarily non-radiological evacuations like hurricanes and things like that that also support our practices. And then it will discuss some of the scenarios that were evaluated as part of the SOARCA study.

So, I mentioned that since the petition for rulemaking denial a couple of years ago or a year ago, we have obtained additional information from around Fukushima. The results of those studies support our current EPZ practices and they don't challenge any of the bases for why we denied the petition in 2014.

So, overall, the assessment we plan on putting in the October paper is that the recommendation should be closed, based on what we put in the petition for rulemaking denial and the current studies.

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We do discuss in the paper that we intend on continuing to work with the international community on long-term health studies around Fukushima and that if any new insights were obtained, that we would use current processes to address those. But some of those will be running out to the mid-2020s.

MEMBER SKILLMAN: Greg, what specific information from Fukushima allows you to make the statements that you just made?

MR. BOWMAN: Tricia, do you want to give specifics? It is mainly dose information from individuals who were monitored after the accident that showed that the evacuation they did in Fukushima was effective. Tricia is the expert on this, so I am going to defer to her.

MS. MILLIGAN: Hi, Tricia Milligan. The Japanese have followed this, put together the Fukushima Medical University Health Study Group that has been following very closely all the evacuated populations. They have done an extraordinarily expensive survey, dose surveys, locations surveys. The highest doses were actually relatively small. The highest child thyroid dose,

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for example, was about 80 milligrams, which is even below what World Health had recommended for use of potassium iodide, for example.

Populations were evacuated. The most at-risk populations were evacuated surprisingly well and quickly.

MEMBER SKILLMAN: Excuse me. At what distance?

MS. MILLIGAN: This was within the 20 miles.

MEMBER SKILLMAN: Okay, thank you.

MS. MILLIGAN: And the populations were evacuated under some very challenging conditions very quickly before the releases started. Doses, overall, were low.

When they have done comparisons, and the Fukushima Medical University has done some comparisons with control pre-fractures at some distance from Fukushima, they have seen absolutely no difference in any kind of thyroid cysts or nodules. In fact what they found is that they have discovered a higher background rate across the country of nodules in child thyroid from what had been expected.

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MEMBER BLEY: Is there a sufficient time for that to have manifest itself?

MS. MILLIGAN: Well, if you look at what happened at Chernobyl, right, we started seeing thyroid cancers in children at about three or four years after.

MEMBER BLEY: Three or four years. So, borderline.

MS. MILLIGAN: So borderline, right. And the doses where were much higher because the population around Fukushima was iodine insufficient and there were no protective actions taken. Those kids drank milk for weeks that shouldn't have been interdicted.

ACRS CHAIR STETKAR: Just for the record, not the population around Fukushima, the population around Chernobyl.

MS. MILLIGAN: Chernobyl, I'm sorry, yes. I knew what I meant. It just didn't come out right.

So, we have a lot of good data with which to compare and draw some conclusions. And you know this is something that will be going on for years and years and so we will have a chance to

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continue this study and participate in the World Health studies. UNICEF is involved because they are very interested in what happens to little kids and thyroids. So, we have good information on that.

MEMBER SKILLMAN: Thank you.

MR. BOWMAN: The next recommendation. The next few slides talk about some of the other various emergency preparedness recommendations that came out of the Near Term Task Force. SECY-12-0095 grouped a lot of these recommendations together into one project plan. They basically fit into three main categories. EPA enhancements for prolonged station blackout on multi-unit events, enhancements to the Emergency Response Data System or ERDs capabilities, and then EP topics related to decision-making, radiation monitoring, and public education. They were all categorized as Tier 3 because of the need for longer term evaluation and because of our focus on some of the Tier 1 recommendations.

Up until our recent work on Tier 2 and Tier 3, we really had not done much work on many of these recommendations, other than the ones that we

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were subsumed into the Mitigation of Beyond-Design Basis-Events Rulemaking, which I will discuss in a minute.

So, the October SECY paper will put the remaining EP recommendations into either Group 1 or Group 3. So, they will be ones that we recommend closing now and ones that we recommend some longer term evaluation.

The Group 1 recommendations are those subsumed by the MBDBE Rulemaking and then some of the others that we were able to assess since we started this initiative.

For the remaining three, we have not had time to do a full assessment and we intend on giving the commission a paper by the end of 2016 with our assessment of those.

So, the next slide just lists the various EP activities -- EP recommendations that were subsumed into the MBDBE rulemaking. So, our plan for the October paper is basically to tell the Commission that because these are being addressed by that rulemaking, they don't need to be tracked separately and they can be closed for all intents and purposes.

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The next slide, slide 53, these are the four recommendations that we believe we can close now based on our assessment we have done over the last few months.

Recommendation 9.3 would have us order licensees to maintain ERDS available throughout an accident and the paper discusses that doing that would be a very costly, if even feasible, based on the initial design parameters of ERDS, it's not a safety system. It would be very difficult to implement such a requirement.

In addition, and we will discuss this more probably in response to the questions but ERDS is a backup system, essentially. We have other ways of getting ERDS data. We have had actually EP drills where ERDS has not functioned properly. So, we have experience in managing an event from the NRC side of the house without ERDS being available.

Recommendation 10.3C, Charlie, recommended that we consider whether to require ERDS to be in a continuous transmission mode from licensees. The need for us to require licensees to transmit ERDS continuously has been previously evaluated and the practice now is that we encourage

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licensees to do that on a voluntary basis by reinforcing the benefits of them. One, that they don't have to do quarterly ERDS tests because we can do that on our side, just based on the fact that the data is coming in. And two, that they wouldn't be needing to activate ERDS during an event. We think that the approach of encouraging licensees to do that voluntary is what we should continue. We don't intend on imposing a requirement in that area.

Recommendation 11.2 --

MEMBER POWERS: How many of your licensees do that?

MR. BOWMAN: It's in the paper. I believe it is 40.

MR. SYDNOR: Forty units at twenty-six sites.

MR. BOWMAN: Recommendation 11.2 would recommend that the NRC work with FEMA, the states, and other stakeholders to identify enhancements to the decision-making framework, including recovery and reentry. So, we have worked with those organizations in an ongoing effort by FEMA to update the Nuclear Radiological Incident Annex for

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the National Response Framework. FEMA does have the lead for that activity with the NRC supporting and they intend on publishing the final update later this year.

Given the progress that we have made to date and the fact that the lead for that interagency work would be with FEMA, we would recommend closing this recommendation in the October paper.

And then finally Recommendation 11.4 would have us conduct training in coordination with our federal partners on radiation, radiation safety, and the use of potassium iodide in the local community around the plants. We have a memorandum of understanding with FEMA which would have FEMA take the lead for such activities. They have updated training, based on lessons learned from the accident. So, we believe that recommendation has been adequately addressed. They do have a program where they continuously reassess the effectiveness of training. And so we think based on that that we can close that recommendation.

The next slide talks about the ones

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that we are keeping open. So, these are Group 3 recommendations. As I mentioned before, these are largely Group 3 because we hadn't done any work on these until this initiative and we haven't had time in the last couple months to assess them efficiently.

They deal with developing an alternate method for transmitting ERDS to the NRC that doesn't rely on hard wired approach; the reevaluation of the ERDS data set, so whether the data that we get from ERDS is sufficient or whether it should be expanded to include additional data points; and then the efficacy of real-time monitoring in the emergency planning of going offsite.

So, again, we are planning on interacting with stakeholders, including ACRS, states, other federal agencies and coming up with a resolution plan for these recommendations by the end of 2016.

I know I went through that fairly quickly. Are there any questions on the EP recommendations?

ACRS CHAIR STETKAR: I just had one

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curiosity. And I know this is a continuing thing so we will hear about it again. The 10.3 -- I will look on the slide here -- A, alternative method for transmitting, apparently, there is quite a bit of discussion there about studies were done and there is a group of concepts and maybe a pilot project. And then based on the pilot project, you may decide on how to fully implement a solution. It didn't sound like rocket science. What am I missing?

You know you are talking about satellite transmission, basically.

MR. BOWMAN: I guess -- I'm not an expert on ERD and how it works but my guess is it would be how we get the data from the plant by satellite to the NRC Ops Center.

ACRS CHAIR STETKAR: I mean people know how to do that, don't they?

MR. BOWMAN: There is also a function of cost --

ACRS CHAIR STETKAR: It seemed like an awful lot of studies and pilot projects and decisions about how to move forward with the process. But again, it is in Group 3, so we will hear more about it. How secure do you want that

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data to be?

MR. BOWMAN: The relation to cyber issues came up.

ACRS CHAIR STETKAR: I didn't know whether that was it.

MEMBER BROWN: Not plaintiff, not all satellite -- I mean a lot of the stuff is general broadcast when you want it for the purposes of just getting information from a plant that is isolated out to some other entity.

ACRS CHAIR STETKAR: Yes, but it ought to be a one-way transmission out.

MEMBER BROWN: It is not a matter of one-way. One way doesn't just go to -- there are fringe elements on any transmissions from satellites. So, they can be snooped, unless the data is encrypted the way you want it to be.

ACRS CHAIR STETKAR: Sorry I brought it up.

MEMBER BLEY: Back in the beginning of this segment, you talked about looking at evacuations from all sorts of places. Is that something you did recently or is that the NUREGs that are called out in the attachment?

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MR. BOWMAN: It's the NUREGs in the attachment.

MEMBER BLEY: Okay.

SUBCOMMITTEE CHAIR SCHULTZ: Greg, is there already an ERDS data set review time frame every five years, every ten years the data set is reviewed?

MR. BOWMAN: I don't know but I will get you the answer to that.

SUBCOMMITTEE CHAIR SCHULTZ: Thank you.

MR. BOWMAN: So, this slide basically just lists the milestones. We discussed many of these already. We do have a public meeting with the industry steering committee on October 20th, where this will be one of the main topics of discussion. The Commission paper is due at the end of October and we will certainly go back and look at that paper again, based on the comments we got from you all today.

We have our full committee meeting with you on November 5th, I believe, November 5th or 6th. And then the Commission meeting is on November 17th.

That covers our next -- Joe, if you

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want to go to my last slide.

Just in summary, we do have alignment -
- I mentioned this at the beginning. We have alignment on the division level among the staff on the recommendations. The paper is with our steering committee for review now. So, it is subject to change, somewhat as the steering committee reviews it and comments. We hope to know for sure within the next week where the steering committee is coming out.

You know one of the things we sort of voted to a few times is the budget and project aim do have -- there is an undercurrent of that in all of this, that we are in a resource-constrained environment and we need to make sure that we focus our resources in the right place. And so our goal with this initiative was to try to get these done efficiently but make sure that there was sufficient technical rigor and whatever recommendation we make to the commission. And we hope that we get there at the end of the day. I understand there are some questions from the committee but we hope we will get there soon.

I will note that overall if we

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implement the revised plan like we discussed, that we would need fewer resources even in 2016 and then in subsequent years, there would be very little resources, unless we identify regulatory action that we need to take like a rulemaking or an order.

So, that concludes our presentation.

I did have -- Richard Lee is here to talk about ongoing research activities, which we heard you were interested in hearing about. So, unless there are questions on Tier 2 and Tier 3 piece of this, I will turn it over to Richard.

SUBCOMMITTEE CHAIR SCHULTZ: Greg, thank you for your presentations. As you mentioned, one of the things that we discussed in the context of some of the recommendations already today was there must be a research component associated with the activity and, of course, in some of them there has been a research component since the day after the accident. And so that, certainly, is contingent and has been a large effort by the staff. But there are some features of that that are going to continue and the committee wanted to be sure that as we have this discussion about elements that are going to be

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closed or closed soon, that we would develop, in parallel, an understanding of what research program has been in place and will move forward as a result of the activities that have been taken place on the regulatory side.

So, with that, I will turn it over to Richard Lee, who has volunteered to make this presentation. Thank you, Richard.

MR. LEE: I came back from a meeting last Thursday. I was handed this whole set of new graphs that may staff had prepared them and they said go to present them. And none of them are here today.

But I think before this committee we have presented the entire severe accident research by the staff I don't know how many months ago.

Of course in terms of the accident research, that is before even Fukushima accident happened or not, we have been supporting risk-informed regulatory activities for a long time and, for example, the combustible gas control 50, I have forgotten, 48, that initiative we are using MELCOR to do analysis.

Operating reactor emerging issues

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continue to arise. For example, if you look at the licensee continued to ask the NRR to relax the leakage from MSIV within the reactor. Those are still pending as of today. And many of them are asking to allow a larger leakage rate. So, we continue to support those activities.

In the new reactor licensing support, of course, we are engaged with the NRO on those and next week we have a meeting with NuScale on discussion on the source term again.

And I am sure when APR1400 comes in, we have to support that one, too, on Chapter 19.

The staff maintained the severe accident from a large knowledge base and expertise throughout this past decade. We are engaged with international research because most of the severe accident research has moved from U.S. to the European, especially in the European research organizations of the past decades.

We continue to maintain our MELCOR analysis code, which we consolidated from many codes into one this past decade and we continue to maintain it.

And then we also like to continue to

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maintain the core knowledge of Iran's reactor safety issues as different advanced reactor or new reactors come to asking for licensing review. For example, it ACR700, the NNGP and so forth.

And in terms of the international collaboration, we have the CSARP, which is the Corporate Severe Accident Research Program started since TMI and continue on today. We are engaged with the CSNI activities, IEA, and also a lot of European Union activities as well, too.

The next one, when we look at the Fukushima accident, we don't think there is any new severe accident phenomena that we have identified, based on the severe accident progression we have analyzed so far. As a matter of fact, at the time when the accident happened, the SOARCA calculation for the Peach Bottom example, if you look at the Peach Bottom predictions for short-term station blackout and long-term station blackout, you will see that the signatures from the Unit 1 will fit with the short-term station blackout MELCOR analysis. And if you look at the other Unit 2, 3, you will see that the signatures are there.

So, I would like to address some of

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the, just as I mentioned to you, the European research are ongoing at the time before the Fukushima accident. After the Fukushima accident, that activities has built up even more in Europe.

For example, also in South Korea, decades ago, they started building up their capability in thermal hydraulics. By the time the Fukushima happened, the South Korean, for example, the Korean Atomic Energy Research Institute has built up its capability on severe accident. They continue to build up their capability. As time progresses, you will see that they can do a lot of experiment. There would be a lot of joint projects between the European and the Asian community.

Before the Fukushima accident, the Japanese have basically shut down all the severe accident research. Of course after Fukushima accident, the Japan Atomic Energy Agency is gearing up all the research in severe accidents, at this time, for the past three or four years. And they are consulting us on every aspect of it.

And not to be outdone by the French or the Germans research in severe accident, the European Commission also launched all sorts of

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research on the Fukushima accident as well.

So, let me move to the next one. In terms of my progressions, we know that in general we have done more experiments in the PWR, invest more progression than the BWR because we did our own research in PWR, the French did their own, and so did the Germans. It is many things in the PWR but in the boiling water reactors, there are very limited experiments exist because it is a very challenging experiment. The scale is very large that we cannot accommodate. So, we did some very limited experiments.

Based on that, we have developed our models for boiling water reactor melt progressions and we have two experiments, or the German has a few, that is the basis for all the severe accident progression prediction for boiling water reactor, despite the uncertainty related to investing in melt progression. If you look at the prediction of the pressure, temperature in the containment, we did not too bad.

But the question remained is that the MELCOR prediction would be different than, for example, MAC, if you go through a mixed prism.

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Back in 1995, the MELCOR adopted two paths, a TMI-like path, which is the forming of crucible and will encapsulate all the molten material inside. So, the steam will not get through it. So, you will not tend to oxidize too much. So, it will be less hydrogen generation.

Those are the turbo accident, when you see a lot of water in the core. But in the lower part is dry conditions, so you continue the ball down. So, we adopted the global path for the boiling water reactors melt progression. So, these remain to be different pathways of calculations.

And if you look at the melt where we do it a little bit differently, if you go to a European code the ASTEC code does it differently, the ASTEC code was really most centric to PWR melt progression because the French and the Germans are driving the European ASTEC code calculation development. And the French, of course, you know that is all PWR in their country. But when the European Union came into place, they need to expand the capability of doing analysis to other reactors within the European Commission that has 27 countries or 29 now. For example, there are

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boiling water reactors, other European Commission countries. They are starting to develop their models into the BWR melt progression. And when they do their analysis of the Fukushima accident, you will find out their melt progression is different than what we did. They are also different from what MAC does.

The Japanese are also have been developing the so-called SAMPSON code and that code also does it a little bit differently.

So, the question arises that when the Japanese open up their reactors, three reactors, concurrently, we would like to have some understanding how they invest their melt progression for boiling water reactor should be modeled. So, basically, it is a guidance for this code on how to proceed. Can we do better in terms of monitoring the boiling water reactor melt progression?

In terms of hydrogen behavior, I want to bring to your attention that the Fukushima happened in 2011. The IEA actually does same year put out a state of the art document on hydrogen. It is a very thick document that came out the same

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year. They had been working on it for many years.

One of the NRR staff actually was on the writing committee, Andrew Groves was on that committee.

Then of course, CSNI commissioned a so-called status report on hydrogen management and related computer codes. This was published in June of last year. It discussed, because of the IEA report, NRC told the CSNI don't go and repeat what IEA did. We want to have a more synthesized report. So, the group has written a report on the hydrogen. So, there is a report that you can look at about hydrogen risk.

And if you look at the conclusion here, they discuss about the paths and so forth and it brings to attention that even you have paths, as Dr. Powers mentioned earlier that when you have a very fast combustion, the paths will not prevent you from damaging your containment or your reactor.

Another thing they find out about instrumentation, they have problems in placing, how many instrumentations you should have and where should you put it, and how many can you rely on during an accident?

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And then also another thing they brought up is that for the passive reactor design, for example, there are no spray -- for example, in the AP1000 there is no-spray, so if stratification occurs, people are counting on a jet coming from the primary system release to disturb this so-called stratified layer and mix the containment. So, there are interests in using the CFD code to do those type of analysis. We participated in one of the European Commission activities a few years ago and we used a FLUENT code for our analysis and we found that our CFD code would over-mix the problem. So, just remember NRC continues to rely on the other code for our contingent analysis, for design base, and for everything, and we think it is still adequate. Until the CFD can develop further, we will continue to rely on it on what we are doing.

I think Dr. Powers also mentioned about this in this superior diagram, the Fukushima blowing up is basically coming from a different direction where you have a hydrogen rich and the air starts coming in. But most of the current experiments are done in a different, they are coming out from the lean condition and hydrogen

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continue to add to it.

So, actually I asked Dr. Powers about what we have done on that actually the people that has done more testing on those areas.

MEMBER POWERS: I simply don't know of any data. There is data all over the place on these things and you can't say that I have comprehensive of that data but that is not the classic way we have done things.

And the problem of ignition in deflagration from -- coming in from the fuel mix side, just becomes kind of -- you have just got to do a test because they are all convection driven, turbulent convection driven. My intuition in that area is as close to zero as it can be.

So, we did bring that to the attention of those people who are doing the PAR experiments. And the South Korea has built an 18-meter tube vessel called the live facility. It is a steel double-wall containment. In other words, they can control the pressure and temperature very precisely because there is a gap between the outer vessel and the inner vessel and there are collaborations between the IRSN and the South Korea in developing

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more study of hydrogen behavior stratification and so forth. In addition, they are going to be doing some past performance in those facilities but the programs still need to go on. We do not know where it is progressing but we know that there is a lot of collaboration between the European and South Korea.

Going to the next one, is that the ex-vessel melt behavior is continued to be in the area of experimental and discussions but most of the molten cold concrete in actual experiments, the melt are usually mostly focused on PBR melt, oxidase melt. There is very little metallic in there because if you introduce metallic into the melt, it is very difficult to run those tests because by the time you mix it, you don't know how much melt in metallic has been oxidized so, it is hard to determine what initial condition is at the beginning of the melt in the action with the concrete.

Then I also asked the questions about the way that the tests are done is that you pull the melt on the concrete and you study the effects of the molten material in action with concrete or

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if you add water on top of it, you study the effects of water. That is the case for the new reactors, advanced reactors that we will introduce water into it.

But just remember, after the melt has arrived for the concrete and also put water on, there is nothing to tell you that there is no other relocation of material from the core into the melt, again, not once, maybe multiple times. These tests are also very tricky to run. The way that the core treat is now is that any new material coming up from the reactor will be added to the molten material. That is the way that the core treated. Is that adequate or not, we don't know.

So, it mentioned about a kind of melt, which is a metallic melt. For BWR, you have a lot of zirconium and materials that it tends to be more metallic melt. We have out of all the tests we have done in this past decade is mostly concentrated on oxidic melt.

Then on the long-term cold concrete in actions the question is that, as you have seen in the Fukushima, the accident can last a very long time. Usually now our tests run 24 hours or so and

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that is how we terminate the test. We cannot run it longer than that.

And then another problem is a so-called stratified melt explosion, followed by the Swedish last year or so. We don't think it is prototypic but there are some EDF, for example, respond to it very, very rapidly. So, now EDF have decided that they are not going to have any water at the time the melt relocates from the vessel into the cavity. So, they are now thinking about even draining every bit of water from the containment sump. I hope it is good luck to them.

ACRS CHAIR STETKAR: Not -- the containment sump or the reactor vessel cavity?

MR. LEE: The reactor vessel cavity.

ACRS CHAIR STETKAR: Okay.

MR. LEE: Yes, not the sump. Sorry. That is too far down.

ACRS CHAIR STETKAR: That sounds industrious.

MR. LEE: Yes, no water in the cavity. We think that the Swedish experiments are non-prototypic and we don't think that the phenomena exist because we looked at it about 20 years ago

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and we have disposed of it. But it is starting to -- it is rising now in Europe and the French is respond. We think that the EDF response is incorrect. But nevertheless, we don't run the EDF reactor.

Okay, fission products behavior. Okay, of course in terms of the fission products, there are no new fission products that we know of from the Fukushima accident but, of course, we added different type of water to it. And for the Fukushima it is salt. We have told them what they can be expecting from the salt when there may be some bacteria growing in there and when they do the decommissioning, they may encounter many problems.

And the AQIS source term is something that NRR asked research to look into because most of our plants are not situated near the sea but next to a river. So, we would like to see what is the calculation now in terms of the movement of these long-term leakage of fission products into the river. And that is under study at this time.

The effects of salt in our well water, we have conveyed our views to that. There is a so-called senior expert group on safety research

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post-Fukushima under the NEA that is started in 2014. And Steve Wells, our Director is on that committee. And it will produce a report sometime next year. And NRC was responsible for writing what the sea water effects on the fish and products are.

And the Japanese are also, of course, interested in the leaching from the fuel in the plant. The waters are leaking from the primary site to the secondary site to the turbine building. They want to drain all the water from the turbine building. The question arises that after you drain it, the water continued to leak into the turbine building. They want to know whether the dose, resulting dose, will affect the people doing the cleanup.

The Japanese are also doing some more pool scrubbing effectiveness at saturated temperature. This means that the pool is as saturated as we don't think that fission product capture will be much there. Basically, it will not retain any fission product.

Okay, in terms of improving our analysis tool, we continue to keep track of all the

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research that are ongoing in the world to keep our code up to date. Usually we will try to, after the conducted research, we will wait until about four or five years, until the dust settles before we implement any changes to our code because we don't really change things quickly until it is assured that it should be changed.

And these are things I already mentioned to you, the mitigation system, monitoring internal safety features, operator actions, I think earlier people mentioned that the MELCOR code was used to develop simulators and those individuals are doing those things.

The next one, improving code numerics. We are looking at the MELCOR code for the next year. Now, we are talking about how the code should be improved because, in this 5.1 analysis that we did calculations for like 72 hours, we run into many code problems like it takes a long time to run because now we are dealing with situation that waters get back added into the system and the thermal hydraulics treatments is giving us some problem and the run time is very slow. So, we would like to decouple the physics from the

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numerical solution. So, we are commissioned the computer scientists and people at Sandia National to look at that and lay out the framework for us to proceed with decoupling the code. In other words, they physics doesn't change that much in the code because those are not the area of changes.

So, we would like to leave solution for the differential equation or partial differential equations to the computer scientists, how to solve it the best they can as the computers and the system advance to the next decades also. That is why we said about all these code improvements, instability problems we would like to solve. We make the code run more efficiently and these are all they are talking about.

The next new graph shows you what are the past decades or so how the experimental program from different countries that produced results that were used to validate the MELCOR code and on the left-hand side are the experimental programs and on the right-hand sides are all the application we have seen mentioned over there.

Okay, next slide. Treatment of uncertainties. Of course they are phenomenological

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uncertainties. Those are very hard to come by, unless you know something different from the experiment, then you change those.

The modeling parameter uncertainties, we have the Monte Carlo sampling, we have the Latin hypercube sampling, but we don't use it anymore because Dr. Powers complains a lot about it every time we use it.

(Laughter.)

MR. LEE: But we stop using it because we don't want to be confused him at presentation.

The uncertainty, of course instrumentation reliabilities. And then also on the SAMG, as I mentioned, the simulators, the MELCOR base, not base simulators has been developed.

In terms of knowledge management, the accident prevention and many severe accident resolution has been completed by the DCA for example one of it. The in-vessel, the alpha mode failure, FCI, fuel coolant inactions. And then from the post-Fukushima we think, I think you look at the prevention versus mitigation. We have a lot of discussion with industry on those. And I think

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you all are asking about the SAMG and we do have a lot of discussion with the owners group which they show us how the SAMG will progress. And I think we do need to discuss with them, we give a better feeling why you think it would be successful. Until you see them, you really don't have an idea what it is doing and they are really plant-dependent.

So, it is really hard for the staff to go and develop SAMG for every plant. It is not something that we should be doing. We can look into it but it is really plant-specific because the systems are all different in every plant. And they can show you how to implement it because NEI, for example, has guidance how to develop it and we have had multiple discussions with them. And they take all these charts around the whole room and you can walk around and look at it.

And then of course we do have financial constraint on what we can do.

And then another thing is that we like to establish sort of a knowledge transfer between NRC and research institutes to maintain a cadet of people that can be trained in in-vessel melt

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progression, expansive phenomena, hydrogen, and CFD. And that procurement is ongoing now. So, I can't tell you any more other than what I just said.

Of course, we are increasing collaboration with international research. We have been collaborating with the IRSN for the past 20-something years. We continue to do so and with Switzerland, the PSI Institute, for example and, increasingly, with the Asian partners, which is the South Korean and Japan. We also know that China is building up its capability. We believe that must be started from the hydraulics area. We don't know what the severe accident area. I mean it is just like the same thing like what South Korea is doing. It is first thing to go up is the hydraulics area and then we move to severe accident because it multiplied.

We are starting to engage with some of the Chinese Institute in severe accident as well. In Japan we start to interact with the EPRI Department in Japan and they are also doing some research for the regulatory agency there.

And the next one is just showing you

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what activities in terms of in different site level. True PRA, we do an in-house analysis. We support the PRA in Level 1 and 2.

The next slide is a MELCOR co-development and maintenance and you can see what the activity is. They are upgrading new advanced reactors and you have AP1000, AP1400 coming in. And also the decommissioning work on the model 99. That is not 90, it is 99.

Production we are supporting in term of the source term evaluations and then on small modular reactor, NuScale, at one time we had the mPower as well.

The next one Fukushima accident. We continue to engage with the DOE and NRC on the Fukushima forensics and activities and then support to NTTF, JLD here.

The PRA Level 1 sets of criteria on SPAR, we continue to do those things but just remember I think all of those -- because we are doing the SOARCA, that is why we are developing the SOARCA info model.

We think the catalyst may come next but we don't know yet.

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And you can see the parallel between the SNAP development and the SPAR development, it is a growing curve.

The CSI with the -- both three CAPS have been published featuring bending hydrogen, the one that I showed you earlier, the spent fuel pool has been done. In number four, the SAMG ones under the leads of the Canadian Regulatory Agency, that is ongoing. And the Fukushima assay SARAF at this time is ongoing until next year.

And then we have the NEA is doing a benchmark exercise on the Fukushima analysis. Phase 1 is completed. Phase 2 is just started.

The FSC security assessment, we are assisting the NMSS to look at these casks, dry casks that are sitting at decommissioned plants and they are reassessing the needs of whether they need to change anything related but this is a security thing. So, I don't have a need to know so I don't know much about it.

Then international domestic research, those things we have discussed.

And then the last thing is the resources. And the committed resources assigned to

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us so we just bide our time so that we can do. And usually by the end of July, the Agency find their money, so we wait and we find more things that we can usually get things done, pretty much.

Session planning because I think both severe accident staff would like to leave this place vertically, not horizontally. So, I put this in we have to think about those two.

And then in termination agreements, now we run into also a problem with the lawyers.

So, that's it. Questions?

SUBCOMMITTEE CHAIR SCHULTZ: Committee questions for Richard, questions on the presentation?

Richard, thank you very much. We really appreciate you providing this update for us.

This will be a good time for a break. When we come back, the staff may have an opportunity provide us some clarification to some of our questions from this morning and then we will have a presentation by industry.

Let's return by three o'clock.

(Whereupon, the above-entitled matter went off the record at 2:43 p.m. and

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resumed at 3:02 p.m.)

SUBCOMMITTEE CHAIR SCHULTZ: We'll go back on the record for the next portion of the session. And what we wanted to do just now is to answer a question that was raised this morning related to seismic capability of fire systems.

So, Antonio Dias is going to introduce the topic from the staff.

MR. DIAS: Hi, good afternoon. My name is Antonio Dias. I am the chief of the Plant Systems Branch in NRO. And I am sorry we were not here in the morning so we could not answer the question as they were being posed. So, I brought Dennis Andrukat and Robert Vettori and we are going to try to address the questions you had this morning.

SUBCOMMITTEE CHAIR SCHULTZ: Antonio, the question was specifically asked by Member Skillman.

MR. DIAS: Sure.

MEMBER SKILLMAN: Let me proceed.

MR. DIAS: Please, thank you.

MEMBER SKILLMAN: I am on page 30 of

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the original task force report and I will read from it because I have been waiting for this opportunity for a couple of years. We have been through the big issues, seismic reassessment, fire reassessment, the SAMGs, the EMGs, and the containment pressure, and variation reduction. So, we have spent the last several years working on what are these very large, overarching issues. And hiding down in all of this is an issue that has been very near to my heart for almost 40 years.

Here is what is in the report, page 30, last paragraph. Fire protection systems are not required to be functional after a seismic event. Therefore, efforts to fight seismically-induced fires may be impaired by degraded fire protection equipment. A seismic event may also impede also fire crews from reaching the site, further challenging the capability to respond to such an event.

Then moving on to the top of page 31, here is the discussion of KK-3, the transformer fire and some other information. KK-3 was Kashiwazaki-Kariwa, Unit 3, another

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Japanese reactor. And perhaps you saw those images because they were captured and they were sent around the world with a transformer on fire and it was an oil-filled transformer.

I go back to a lot of years at one site in specific and multiple years consulting at other sites and raising this issue, what is the capability of the fire protection equipment. It has always been well, it is something a little bit better than commercial grade.

I also have experience in the early designs when our guidance was the general design criteria and then, later, interpretations that came from Reg Guides 1.26 and 1.29. And those three documents really provide what is the current design of the current fleet. And in all the cases, fire protection equipment is, basically, high-end commercial but it does not share the same quality requirements, seismic requirements, inspection requirements as ECCS. Yet, the risk of a fire, in my view, is as great in terms of damage, loss of the facility, and other

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consequential effects on the facility.

So, my question is why isn't now the time, under Recommendation 2.1, for new plants, pick a date after January 1 of 2017, fire protection systems will be seismic 1 equivalent to the systems that are required to shut down and cool the plant, to maintain containment, to prevent offsite does releases in Part 100. Why don't we just do it?

MR. ANDRUKAT: I will go ahead and start off. Dennis Andrukat, Fire Protections Unit, Office of New Reactors.

So, to clarify my portion and my understanding for being here today, I cannot speak to the recommendation portion. I can only speak to my understanding of what new reactors require as far as fire protection systems and their seismic qualifications. I don't know if you want to hear that portion but I cannot speak to --

MEMBER SKILLMAN: If you tell me they have got to be Seismic 1, then I'm done. I'm great. If you give me a reason why they shouldn't be, then I where I have been for many

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years, saying to myself how come. Why not? These systems are very, very important.

MR. ANDRUKAT: So, I can start off with a brief history of the current guidance. I don't work with operating reactors. I want to be careful to speak for the operating fleet and any guidance that they have followed.

But for new reactors, there is a portion of the system has to be able to withstand the safe shutdown earthquake. And we refer to that as the standpipe system serving safe shutdown events.

So, there is a potential, if you will, that we could have a plant that not all of the suppression systems are seismically qualified. In addition, the standpipe systems that are required to survive the safe shutdown earthquake are built to ASME B31.1 power piping for equipment.

There is a statement in the guidance, in our Reg Guide that does talk about for fire suppression systems, therefore, the remaining systems, the sprinkler systems, the water spray systems. If you are in a high

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earthquake zone, then there is due consideration to also make those so they would be able to survive.

MEMBER SKILLMAN: So, Dennis, let me stop you right there. Are the suppression systems the headers spraying equipment protecting? Are there any equipment that are seismic?

MR. ANDRUKAT: So our suppression system would be two-phase. One, either control the fire and/or to protect systems needed to safely shut down the plant.

MEMBER SKILLMAN: Are those, the ones in the latter category, are those seismic, seismically designed?

MR. ANDRUKAT: The equipment?

MEMBER SKILLMAN: Uh-huh.

MR. ANDRUKAT: That, I don't know.

MEMBER SKILLMAN: I think the answer is yes.

MR. ANDRUKAT: Okay.

MEMBER SKILLMAN: And so I would simply offer on the record there is a string of logic that requires equipment that is used to

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shut down and cool down the plant, to protect the containment, prevent offsite dose releases must be Seismic 1. And we know how to make that equipment Seismic 1. We know how to buy it. We know how to qualify it. We know how to install it. We know how to bolt it to the bulkhead or the floor or whatever, suppression restraints that are essential to capture this system and ensure its functionality for a seismic event up to a certain level but it is the design base of the plant, the SSE.

So, why don't we have that same requirement in words that are just that clear for the fire equipment? Is it an expense? Yes, it is. Is it worth it? Yes, it is. But not for a plant, not for a back fit, but say for a plant that would be built in the future, where there is no action today. I am not suggesting a back fit. I am well aware of what owners have done to protect their firefighting equipment and to protect their equipment but it just seems that this is a hole in the armor of the regulatory guidance that is relatively easily fixed by perhaps one sentence in a reg

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guide. I don't know if we would need one sentence in the general design criteria but it is easily fixed because those who are in the business know exactly what it means. There is no magic.

But if you say there is equipment to protect, there is firefighting equipment to protect, seismic equipment, I would say why isn't the firefighting equipment at that same quality level and the same seismic level? It seems to me to be a logic that simply makes sense.

MR. ANDRUKAT: If I can ask, is the question more towards a failure of the suppression system getting water onto sensitive equipment or is it more the question of can he protect the safe shutdown equipment post-earthquake but with a fire event?

MEMBER SKILLMAN: It is precisely the latter. It is to ensure that the functional capability of the firefighting equipment is there when it is needed to protect essential equipment that has just sustained or is sustaining ground motion, earthquake.

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MR. ANDRUKAT: So, we do maintain that the manual suppression capability remains functional for those areas that are credited for -- the equipment credited for safe shutdown post-earthquake events. That is, manual suppression which is fire hoses, fire brigade. That is what the guidance is speaking to.

MEMBER BLEY: So that would say that the fire main would have to be Category 1, if you are counting on the fire main for your manual suppression.

MR. ANDRUKAT: So, it would -- I want to be careful to not necessarily Category 1 but at least to the ASME B31.1 Power Piping Standard. Yes, it would include those standpipe risers that serve equipment, safety related -- not safety related areas but areas that have the post-fire safe shutdown equipment that you are post-safe shutdown earthquake.

ACRS CHAIR STETKAR: You said post-fire safe shutdown equipment. We are talking about seismic events.

MR. ANDRUKAT: Correct. Well you also have a fire. So, it is the equipment that you are

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relying on post-seismic event for safe shutdown.

MEMBER SKILLMAN: No. A couple things. First of all, B31.1 is a piping code and that specifies allowable stress intensities in models for a certain class of piping. What that simply says is that for this equipment in this system, it will be designed to B31.1 and B31.1 will identify what the allowable stresses are for that piping.

Now, an input to that analysis is seismic acceleration. And you put it under B31.1 is the seismic input.

And what I am asserting here is for many, many years, we have not had the requirement for the firefighting systems, specifically for the installed headers, fire main, fire pumps, fire piping that runs throughout the plant to be at some seismic level that ensures its functionality through a plant designed seismic event. SSE would do it for me.

I'm not trying to specify what the seismic levels should be. I'm simply saying we design ECCS, the reactor coolant system pressure boundary, all of our Section 3 Class 1 and 2 and most of our Class 3 piping to Seismic 1. My view

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is that the fire plumbing, the fire hardware, the storage tanks, the risers, should all have that same seismic requirement.

The fire system should appear very similar to emergency cooling.

MR. BOWMAN: This is Greg Bowman of JLB. I think we certainly understand the comment. I'm not sure they are going to be able to give you anything that is going to satisfy you but we will take that back, certainly.

MEMBER SKILLMAN: Thank you. And I understand that ECCS and ASME Section 3, Class 1 and 2, Seismic 1, I understand that. And the quality requirements on those are very, very high. I understand that. But it would seem to me that all fires should be ASME Section 3, Class 3, Seismic 1, with an appropriate amount of quality assurance and ensures the fire pumps, the fire valves, anything that is automatically actuated shares approximately the same pedigree as what we would say is much likely a spent fuel system. Most spent fuel systems are ASME Section 3 Class 3. They are Seismic 1. It is relatively thin wall pipe that is designed to take the plant seismic

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event and not fail. And that is simply all I am saying.

And I thank you, Antonio, for coming down and talking with us.

MR. DIAS: We now know the depth of the question and they are going to work on this. And as Greg mentioned, we are going to provide an answer to this.

MEMBER SKILLMAN: Yes, my belief is that this is a deficiency that has existed for a long time and because of it, we have had all kinds of exercises in the industry for fire protection. If the fire equipment were Seismic 1, I believe that, at least going forward for future plans, this issue will resolve itself.

MEMBER BLEY: We were just talking over here. This is related, I think, to something that has come up in many other areas. And I'm not sure if it is where it is embedded in the regulation but there is a concept that certainly affects how we build our reg guides, how we build our guidance for many things that comes back to saying you only need to think about one of that happening at a time, which is kind of alright, if they are rare events.

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If they are connected events, subsequent events, it is not so all right.

And I think there is a lot of spots like this where we have left holes because we only look at one thing independent of everything else, when in fact the event that gets us in trouble causes subsequent troubles elsewhere.

SUBCOMMITTEE CHAIR SCHULTZ: Other comments on this issue by other members of the committee?

MEMBER BLEY: I'll just throw a plug. And a good PRA will help you deal with those, if you use it without changing everything everywhere else to try to track this idea.

SUBCOMMITTEE CHAIR SCHULTZ: Other questions from the committee for the staff, this staff or Greg associated with the presentations today before we move to the industry?

All right, we will make a transition, then, between the staff and industry. Steve Kraft.

MR. KRAFT: All right, thank you, Mr. Chairman.

SUBCOMMITTEE CHAIR SCHULTZ: Yes, let me welcome you to the podium, Steve. Thank you

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very much for coming and making the presentation.

MR. KRAFT: Thank you, Mr. Chairman. As Steve said, I'm Steven Kraft, Senior Technical Advisor at the Nuclear Energy Institute. I appreciate the opportunity and I think I have said this more than once but I do mean it quite sincerely, I generally enjoy spending my time here, especially over there.

(Laughter.)

SUBCOMMITTEE CHAIR SCHULTZ: Let the record show he pointed to the back table.

MR. KRAFT: Someone from NRC, during the break, said are you going to -- do you want me to stay and help you out? And I said why? I don't need any help.

So, first of all, a bit of quick disclaimer and background. We have not seen a paper. And I made that point in an email to staff, Kathy Weaver.

MEMBER BLEY: I'm sorry, I missed what you said.

MR. KRAFT: We have not seen the paper you have seen.

MEMBER BLEY: Oh.

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MR. KRAFT: And I made that point in an email to your staff, Kathy Weaver, and shared with both Steve and John. The only thing I can say is sometimes we do and sometimes we don't. And it sort of puts us a little bit at a disadvantage. And all I can say to that is I lost count of the number of times, John, you said you are saying this here but the paper doesn't say that.

What I have always been impressed with is your encyclopedic knowledge of any paper put in front of you. And there was a moment when you were looking at the regulatory study for the spent fuel pool question and I don't know if it was 2013 or 2014 and whoever it was had a chart up with some community population data, as I recall. And you said wait, wait, wait, that data is not the same as graph 14.5.7.

And I could tell you a story from my father-in-law's history about using a number out of context and how it saved the day but the point is that drove the NRC staff to look.

And of course what happened was was that the dataset that drove the chart in the document was the same dataset that drove the chart

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but they didn't check and they discovered a broken link. It turned out it was pretty important. I thought that difference in community data drove some, oh, we must do this number again, and it didn't make any difference. But it wasn't a trivial you have got something wrong. So, that has always impressed me.

And so when you do that today to great effect, it just makes the point far clearer that it is very difficult on these issues to understand what the staff is presenting without the paper. And they certainly don't have to make it in advance. I think there are rules of procedure for that and that is fine. I respect that and value that but the fact of the matter is, I don't have it.

And what was really very interesting and, of course, Kathy, again, was really kind to me yesterday and sent me the slides. So, you don't really understand the story because the music doesn't always tell you the words or the other way around, or whatever analogy you want to make. So, I am a little hamstrung but okay.

The second thing I want to talk about

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is a question that I think comes up is the directionality of information. I invented that concept at lunch but the directionality of information. And what I really mean is that when the industry proposes something, whatever it might be, and we have to come to the staff for this committee, the commission itself, and we do all of our homework, do our analysis, and we amply present it. We expect the staff to comment on it. Staff comes up with something. It is the other way around.

So, the fact that maybe we haven't done full analyses of all of these issues is really because it wasn't us proposing it. It was the staff.

And the other point was maybe that is even more important and I want to suggest that that discussion at the very beginning on seismic-induced fires I thought was a very, very good example of how the second part of this process was meant to work.

For the last four and a half years, we have been focused on implementing all the Tier 1 actions and we still are. There are still plants

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that need to finish over the current round of this season's outages and then two outages next year, and then you have got a couple of outages for the years after that for the event order implementation. You are still working on the 50.54(f) reviews for seismic and flooding and getting an alignment on that guidance, as evaluation is still going on.

So, this particular issue -- and I'm not picking on this issue because of the issue itself. I'm just saying it was a good example. How many people do you think in this room sent emails and texts to your contacts at EPRI and asked about the Brookhaven -- did you know about the Brookhaven report or that EPRI report that was going to come out? I'll bet you ten because I was sitting there seeing it as well, a lot of that correspondence. And I will tell you what the answer was.

During the time that the Brookhaven workshop was held, as important as it was, EPRI was sequestered by the industry on seismic. We had 180 seismic experts out in California with one NEI staffer, bless her heart, and we had a lot of work

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going on and they simply could not attend.

Now, one of my colleagues at the office had the time to dig up the summary report, Ada Adams and she sent me a list of who was at the meeting. There were seven so-called industry people at the meeting; there were two utilities; everyone else was a consultant. So, that tells you where the focus was. I'm not telling you it is because we don't know anything about the issue but it tells you where the focus has been.

So, I am not going to walk through my slides. I will simply leave this one up. It is the only one that really matters. You can look at the other ones at your leisure. It's nothing you don't already know.

The point being that the biggest bang for the buck in safety is the Tier 1 requirements, which we are implementing. Many of those Tier 1 requirements are being implemented in ways that the industry suggested. If you go through the history of Fukushima requirements starting with the Near Term Task Force report, what was it SECY-11-0025 and 0037, the whole list of them, there are points in there where you see the influence of the

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industry suggestions. I won't go through all -- it's not worth going through all of them. We are very proud of a lot of them that we came up. But the fact of the matter is, that is what we have been doing.

Where does that leave us? I completely concur with everything the staff has said about closing, and let me just reserve on telling you what I mean by closing the Tier 2, Tier 3 issues, moving everything that is left into regular process, and the idea that we all monitor for new developments has always been standard practice. We always pay attention. We are always involved in standards development and I will talk to some of those things, if you like, under the different issues. The point being that --

Oh, and I thought one of you said, maybe it was you, John, asked or read the question of -- I may be wrong who asked it -- you have changed the meaning of Tier 2/Tier 3. And the answer was yes, you are right, it has evolved. Of course it has evolved. It always evolves. Everything evolves.

And what happened was is that as

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everyone walked through it all, spent fuel pool offload was a Tier 3 issue but someone thought it was important enough to make it a Tier 1 issue. We didn't expect that workload. I don't think you did but it was important enough to do and we did it. And you had the EPRI work that was done that was kind of related to it and we know what happened with that issue. So, there is an example.

There were other Tier 2 issues. I can't enumerate them all, maybe they were the EP ones that got brought into Tier 2 -- Tier 1. I'm sorry. I don't think right now there actually is a so-called Tier 2 issue. I think they have been dispensed with either in the mitigating strategies or -- sorry, I shouldn't call it that -- the MBV whatever rulemaking. So, that is different than the binning that Greg proposed.

Secondly, thirdly, when I look at the list and I'm surely not going to waste anyone's time here by going down my views on each topic and I am going to stop in a minute and simply ask you all a question, I would look at these issues in a slightly different manner. Although I have no problem with the binning that NRC staff is

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proposing, I just think from my perspective I would look at them differently.

For example, I would suggest that long-term development is a bin, what we are going to look for long-term. That doesn't mean we walk away from an issue; where we discover there are no -- at the moment, there is no need for a regulatory requirement; issues that are, in the famous phrase of my one of my bosses back in the office, there are issues that are done done, although I have to remind him constantly that there is no such thing as that second done because there is always an opener available; what is in the Beyond-design-basis Events Rule is another bin; and what can we close out now.

And I am not going to suggest we put them in these bins but it is a different sort of way to see them.

With that, the best thing to do without really wanting to suggest I know what you want to talk about, why don't we just go to questions and I will do my best?

SUBCOMMITTEE CHAIR SCHULTZ: Thank you, Steve. Questions for Steve?

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MEMBER SKILLMAN: Yes, Steve, you said -- my sense of what you said is that it is important to keep these recommendations in context. Those aren't the words that you used but that is the meaning that I interpreted from what you said.

I would ask you this question. Do you see the Fukushima recommendations potentially from two perspectives? One perspective is what should be done for the currently licensed plants and, independent from that, what have we learned from the Fukushima events for plants that are not yet built?

Because it could be that what we are doing for the plants that are currently licensed, are actions that we are working hard to avoid back fit on and it is our intention to ensure that those plants are fully and completely safe. But, for a plant that is not yet licensed or one that hasn't come before the staff for review, we might make changes in how they should be designed so that there never will be a back fit question for them.

I see these as two independent ways to think about these recommendations. One is how do you ensure the presently licensed plants are as

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safe as they should be for their design life and, independently, what did we learn from Fukushima that we should apply to any new plant so that we don't have a back fit question ever again on those plants?

By chance, do you see it that way?

MR. KRAFT: Well, by chance, I don't work in new plants and am not familiar with it as I would have to be to give that a really thoughtful answer, although I do appreciate that you distinguish between plants that are already licensed, new plants that are already licensed which we have four. Right? So, they would be subject to back fit because that is the way the rules work.

The only thing that I can say, oh, and I should have said in my opening, if it comes to it and there is an interest, and whether it is the November meeting or some other time, and you would like to get into these issues in greater detail, I will show up with the smart people, sit them over here and let you have at them.

But the specific answer, in the Mitigating Beyond-design-basis Events Rulemaking

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vote sheet from was it the chairman, when they told the staff to remove the new plant requirement that kind of got dropped in from nowhere, in fact someone used the term, one of the Commissioners used the term parachuted in, not my term, but said that there was a policy statement on new plant and followed Fukushima that made clear that it should be risk-informed, like anyplace else. And you should strive to achieve these requirements in your risk-informed way.

And that is the only answer I can give you because whether that turns into separate new requirements or whether it turns into something else, remains to be seen. I mean it is a fact of life, of course that new plants have greater margin, you know all those things that are designed into the plant. But at the same time, you have got to draw the line someplace and I think that is really all I can say and I would very much like to have someone else come in, one of my colleagues come in and talk about that and who is closely engaged in that activity. But I do, I mean that is the only answer I can give you at this point.

MEMBER SKILLMAN: Thank you, Steve.

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SUBCOMMITTEE CHAIR SCHULTZ: Other questions or comments to Steve?

ACRS CHAIR STETKAR: A pragmatic question. We are going to be brief during this issue at our November full committee meeting. And as always, we do honestly really appreciate the input from the industry.

Now that you have the opportunity to see the draft paper, do you expect that NEI will have some more substantive comments on each of the recommendations?

MR. KRAFT: Okay, I can make a categorical commitment on the November is it 5 or something meeting?

ACRS CHAIR STETKAR: Yes, I don't know whether we have the actual date set. It's that week.

MR. KRAFT: I can't make a specific commitment. I don't know my own calendar and I don't know the calendar of the people I would need. So, let's just say yes and we will take that as --

ACRS CHAIR STETKAR: I think we would really appreciate that, Steve, because sometimes the different perspective helps to balance things.

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I mean you know if your calendar -- we have to set our full committee meeting agenda in about a couple of weeks or so for *Federal Register* notice purposes. So, work with Kathy if you do have some sort of schedule constraints. We just want to make sure we have time for it.

MR. KRAFT: Yes, absolutely. And as long as Kathy keeps in touch, we will work out the timing and work out the people and really, we will look at the report.

I did have a chance to look at the slides, of course, and just did a quick run through probably last night or this morning and listened to the conversation today. So, I don't walk out of here completely devoid of having some technical discussion.

ACRS CHAIR STETKAR: But as you said in the introduction, it really does help to sit down and read the text.

MR. KRAFT: I did want to offer a couple of thoughts on one or two of the items. On the discussion of the beyond-design-basis rotation and of course then you went into the post-severe accident implementation, everything that was said

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by the staff about what is in the SAMGs is absolutely true. The technical support center -- what Tim said about on the SAMGs, themselves, when you physically look at them, there are charts and graphs for the operators to do. They are trained very closely. We have used them. Ever since the TMI accident, we have had to have a shift technical advisor in the control room all the time. And that individual walks around and looks over the shoulders and is a highly trained nuclear engineer with the right training and goes through, understands how these charts and everything work and I will just point out that it is not for lack of information.

And then, of course, the moment the event happens, the shift manager becomes the emergency director, stands up the ERO -- there are processes, time limits to do that, stand up the ERO. The ERO includes a Technical Support Center. People who have pagers are required to show up within an hour, stand it up. The Technical Support Center has teams in it. There is the core melt team. There is a this team and a that team and they have specified duties, they have specified

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things on their computers, whatever models they happen to run, and they are looking for are we seeing the conditions that are going to lead the wrong way and what do we want to recommend be done. So, that happens.

But on the SAMGs, there was, in an attempt to have John not regret his decision on the voting on that because we certainly would not want that to happen, we offered and what we are working on now is a licensee document commitment to maintain SAMGs and there actually is a form working its way around the industry for comment. We will show it to the right staff at the right time and get it endorsed. Licensee document commitments are in your license that makes it inspectable. So, you have the ROP thing coming through. You have that coming through. So, you will have that ability, in terms of what is already available, if you care to -- the owners groups current revisions of what they call the EPG/SAGs, Emergency Procedure Guidance/Severe Accident Guidance Rev 3s and we spent days training the staff on what they say, specifically for the event order but it actually went broader, something we have offered here as

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well. We are more than happy to do that.

So, I would just put the point out that there is more to that than I think was really being expressed from this side of the table because the staff only really knows so much about it, the knowledge is really in the owners groups and the utilities.

Also, there are a number of areas where the staff invoked EPRI involvement and when I saw the slides yesterday, I quickly called some folks with EPRI and verified what was absolutely the report that is going to be coming out on seismic induced floods and fires.

By the way, the other hazards and periodic updates on hazards; so, you heard that the staff is proposing putting a program together in research. There already is a program like that at EPRI that relates to INPO, where INPO has it in one of its industry, I forget what they call these things, the IER is the term and there is a number on it that says you need to be aware of this stuff. And so every utility has brought into an EPRI program where they will be scanning research developments and then something pops up and they

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will say hey, something has popped up, you pay attention to it. And maybe EPRI, okay now once you analyze it, they have these spoken studies. I can't say how this is all going to work.

MEMBER SKILLMAN: Steve, IERs are Industry Event Reports.

MR. KRAFT: Thank you very much. It is the closest thing INPO comes to an order. They can't do that. There are probably legal reasons why they can't do that. I hate to invoke lawyers but they are read as orders. For example, immediately following the accident IER 11-1 was go walk down your SAMGs, for example. That was done long before NRC said you are going to have a TI and show you the same thing. Not that it was a bad thing that they did but I'm saying -- so, we do have that process in place. And there are other such processes in other such EPRI involvement with NRC and particularly for the research. And they have an MOU, as you know, to do all that work.

So, we are connected. They are aware of it. I didn't hear anything said today that suggested that EPRI was not connected and that the staff here was not taking advantage of it. I just

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wanted to make that point.

SUBCOMMITTEE CHAIR SCHULTZ: Other comments?

Well, Steve, I would like to thank you very much for the discussion and second John's invitation to the full committee meeting, certainly. And I will make sure that, or Kathy will make sure, I don't have to make sure that she will do it, that you get the documentation as soon as it is available for release to you.

MR. KRAFT: Thank you. I understand that we have these periodic joint steering committees meeting including the NRC Fukushima Steering Committee and the Industry Fukushima Steering Committee not for a long time, every six weeks, something like that. There is another one coming up fairly soon. I understand, these Tier 2, Tier 3 issues are on that agenda. So, we will be talking about it in a little more detail then.

So, the information will be available.

SUBCOMMITTEE CHAIR SCHULTZ: Well, there is the industry public meeting that is scheduled for later this month.

MR. KRAFT: Is that the same thing?

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Yes, that is the same thing.

SUBCOMMITTEE CHAIR SCHULTZ: Okay, good. All right no other questions from the committee? All right, thank you very much, Steve.

With that, I would like to take the opportunity at this time to ask for public comments. Kathy will go to open up the phone line. While she is doing that, I would like to ask if there are any members of the public in the meeting room who would like to make a comment.

Not seeing anyone in the meeting room who would like to do so, I will wait for the phone line to be turned on. When it is turned on, I will ask the member of the public to say hello. I will tell you when I think it is on.

We think the phone line is open. Can someone say hello? I don't hear anyone on the phone line. I also don't hear as if the phone line were on. I don't hear any noise. Can we double-check just to be sure?

MR. LEWIS: Hello.

SUBCOMMITTEE CHAIR SCHULTZ: Okay, thank you. If you would like to make a comment, please state your name and do so.

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MR. LEWIS: My name is Marvin Lewis. I am a member of the public.

SUBCOMMITTEE CHAIR SCHULTZ: Yes, Marvin, please proceed.

MR. LEWIS: I really was interested in this whole subject here, SAMGs, Severe Accident and Mitigating Guidance. This is something that we have got or we are going to get a better look on it. We are worrying about FLEX. We are worrying about this. We are worrying about that. At the same time, I don't see any coordination between all of it, between SAMGs, between FLEX, between what.

We know that these things occur in the same accident, in the same location, at the same time. They all are not -- I don't see them being set up to act in reference to the other ones. They seem to all be acting independently. Maybe I am misreading it. I hope I am.

All right, thank you all for now.

SUBCOMMITTEE CHAIR SCHULTZ: Thank you, Marvin, I appreciate your comment.

Others on the phone line who would like to make a comment, please introduce yourself and proceed.

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Anyone else on the phone line who would like to make a comment? Hearing none, at this point we will close the phone line.

While Kathy is doing that, we can start our discussions. Comments by members of the committee. Charlie, comments on the discussions today?

MEMBER BROWN: I've said my piece on the instrumentation. I think that is documented satisfactorily.

SUBCOMMITTEE CHAIR SCHULTZ: As we go around the table, any particular comments? We could talk about the format for the presentation but any particular elements that we believe the staff needs to present to the full committee, we ought to do so. I will talk at the end about what I think the format ought to be and we can discuss that.

Ron?

MEMBER BALLINGER: Nothing.

MEMBER BLEY: The only thing about the full committee meeting I would say is some of these communication problems that we had reading the document and looking at their slides I think they

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cleaned up with their talking ought to get rolled into the presentation so we don't have the same things again.

SUBCOMMITTEE CHAIR SCHULTZ: Agreed.
John?

ACRS CHAIR STETKAR: Yes, I don't have anything more on that but certainly, I echo Dennis's concern about clarity for the other committee members so we don't get bogged down between what they read and what they hear.

SUBCOMMITTEE CHAIR SCHULTZ: Thank you.
Dick?

MEMBER SKILLMAN: Yes, Steve, I would just reinforce the comment that I made earlier that the context of the original recommendation be made clear in the SECY so that there is no doubt in any reader's mind that the original intent has been addressed. That doesn't mean that the final closeout of the recommendation accomplishes specifically what the original recommendation intended it for it to accomplish but, at the very minimum, there is an explanation of what the context of the original recommendation was and how that original context has been addressed, so there

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is fidelity between all that work that was done back in 2011 and what these recommendations are finding coming to fruition.

And I would just repeat my desire that there be a recognition of the importance of the fire systems be Seismic 1. Thank you.

SUBCOMMITTEE CHAIR SCHULTZ: Thank you.
Pete?

MEMBER RICCARDELLA: I don't have any comments, Steve.

SUBCOMMITTEE CHAIR SCHULTZ: From our consultant, Bill Shack?

MR. SHACK: On the specific thing here, I think there needs to be some clarification, perhaps, in some of the documents, although, I felt they were, by and large, pretty good, myself. So, I am less adamant than some of the other members are about a need for improvement here. It seemed to me fairly clear.

They are obviously influenced by Commission actions, which it is not a staff decision, it is a Commission decision and are influenced that way.

In the technical sense, I think the

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committee does need to see the SAMGs. I don't know how we managed to go all these years without looking at them but we have done that. And that just seems to me we had -- it is now become an important part of the defense-in-depth situation and it really does need to be looked at. So, that is something to put on the committee agenda for the future.

Like Dick, I am a little puzzled. I guess I was around here when we did Reg Guide 1.189 on the fire protection systems and we accepted the fact that all you do is to have to consider the need to design the fire protection system to survive the function after a safe shutdown earthquake. And then they are supposed to do for phenomena of occurring once every ten years for floods. Again, I think it would be nice to have it work at the design-basis flood and how those decisions were made. But again, that is an issue that is sort of off the topic.

So, having lived through with the fire protection guide comes around for the ACRS at some future date, you know, you can fight that one out.

SUBCOMMITTEE CHAIR SCHULTZ: Thank you.

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I would like to echo some of the comments by the members.

For you, Greg, one is with regard to the document and its clarity, as we identified in earlier comments today, and some of this may be happening with this current review that is ongoing, as it is going through the management review process, I think, I feel it would really benefit from an up-front description of exactly what is being meant by the terminology that is going to follow and the statements that are going to follow with respect to disposition of the items and what that really means. And it may help some of the items in a clear way to describe what is being done, what is not being done, and what is being put in a different process. We seem to, many times, just default to a general statement, a generic statement that this will be subsumed into the general process that the staff has versus specifying what that -- where we are really intending for it to go and how it will be accomplished. I think that would really help the document.

With regard to the presentation to the

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full committee, we will not schedule a full day, as you know. And therefore, I think the way you presented it -- at first I thought well you have a Group 1 and a Group 2 and a Group 3. You would do it that way. I think what is probably important is that you focus right up front -- in either way you do it, you focus right up front describing very carefully what those definitions are. You hurried through that today because you wanted to get to the meat of the discussion. But for the full committee meeting, that is going to very important to establish that.

You identified those and then you grouped the presentation in terms of topic and you went one, two, three, one, two, three by topic. I think that is okay but just in terms if you organize that and put up front what you are going to do and perhaps spent a little bit more time on a summary of the full list at the beginning and walk through it and then identify which ones you are going to discuss more fully, you will get to a point where you have got a two-hour presentation or an hour presentation that the committee can react to and spend two hours on and get the full picture.

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Any other comments related to the presentation? I think that will do it. John?

ACRS CHAIR STETKAR: Every time I hear it, I really agree with you, Steve, that something up front to make it clearer to the remainder of the committee members who didn't have the benefit of this discussion, who may or may not read a transcript of the meeting, would be really useful. Especially, not only this notion of the staff's conclusions regarding proceeding in the context of could they justify rulemaking or not as part of the process but also in the areas where the staff has decided that the normal staff activities are adequate to follow through.

Because it does trace back to something that Dick said, in the sense that the original NTTf recommendations were made in the context of what the staff was doing at that time. And they recognized -- you know they spent a lot of time how the Agency operates and what it does.

SUBCOMMITTEE CHAIR SCHULTZ: And they not only spent a lot of time, they brought it to the committee, they brought it to the management, even though that process was done in a short period

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of time, it continued over the next year and a half to develop into the overall program that we had been working on.

ACRS CHAIR STETKAR: But my point is that they made their recommendations in that context. They didn't say that the regulatory process of the U.S. NRC is broken. They said we understand how it operates and here are some areas where we think it merits more careful examination and perhaps enhancements.

And I think there could be a danger, unless the staff explains a little bit more fully that just says well, the status quo five and a half years ago is okay; we are just going to go back to that. And that doesn't necessarily seem to directly address the Task Force's concerns.

So, somehow making, drawing that link that Dick talked about. I don't know how you do that efficiently but that is your problem.

MEMBER SKILLMAN: Let me -- I think that there is a good story. You start with 12. Actually, when I poured through this four years ago, I came up with, I think, 37.

MR. BOWMAN: Yes, that is what I

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remember.

MEMBER SKILLMAN: And you now what? Almost every one of those has been addressed and really well. Some have taken longer than others but there really were more than 12.

But the context of the 12 gave us the big four or five seismic walk downs. The spent fuel instrumentation took on a life of its own but it was good that it did because of the national angst surrounding that. And there are a couple of examples like that. But it seems, while it could be painful to account for all 37, I think you have got a good start on the 12 and gee, oh, by the way, here are a couple of others that really took on lives of their own and here is what we did with those. Here was the context.

I believe that would be valuable. I really do. Thanks.

MR. BOWMAN: Thank you.

SUBCOMMITTEE CHAIR SCHULTZ: One last general comment. Greg, going back to the document, as well as the presentation is I am certainly going to go back and reread it and look for those areas where I know it does say or it seemed to refer to

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commission decisions as being rationale for not doing something. And again, going back to Dick's comments just now, that is not what the Task Force was looking for when they made their recommendations. There were these several items for opportunity for safety improvement, which had not been recognized, many of which had been recognized before the accident. But here comes this accident; it reminds us of these things that we ought to pay attention to.

MR. BOWMAN: We did try to do that. I didn't want us going in to rely on some analysis we had done for rulemaking and say we don't need to do any action.

SUBCOMMITTEE CHAIR SCHULTZ: Good.

MR. BOWMAN: That would be our goal. I think there are a lot of other factors between each one.

SUBCOMMITTEE CHAIR SCHULTZ: I certainly had that impression as we went through the discussion but reading the words and seeing some of the bullets kind of left that impression and that is why we talked about it today because, certainly, in the public forum, I didn't want to

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leave that impression at all.

MR. BOWMAN: We appreciate you.

SUBCOMMITTEE CHAIR SCHULTZ: You have the public meeting coming up. We would appreciate any comments at the full committee meeting, maybe you have a small section associated with what you learned from the public meeting. That would be helpful for us.

ACRS CHAIR STETKAR: Greg, I think reading the words, I highlighted a lot of things because I tend to read it trying to put a member of the public's hat on when I read it also. And I think many times you, everybody involved in the process, have been so close to it that you understand what every word means. And we, ACRS, faces the same thing. We have been challenged many times where we go through our deliberations, write a letter, where we all know exactly what every words means.

You go back and you read the thing a couple of months later, after receiving some comments and say well, yes, we didn't really express that very well. So, that helps sometimes.

SUBCOMMITTEE CHAIR SCHULTZ: Any other

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comments? With that, then, I will close the meeting.

(Whereupon, the above-entitled matter went off the record at 4:01 p.m.)

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Plans for Resolving Open Tier 2&3 Recommendations

ACRS Fukushima Subcommittee Meeting
October 6, 2015



Background

Tier 2*:

- Need for further technical assessment and alignment.
- Depend on Tier 1 issues.
- Depend on availability of critical skill sets.
- Do not require long-term study.

Tier 3*:

- Require further study to support a regulatory action.
- Have an associated shorter-term action that needed to be completed to inform the longer-term action.
- Depend on availability of critical skill sets.
- Dependent on the resolution of Recommendation 1.

*Some Tier 2&3 recommendations have been subsumed into Tier 1



Resolution Approach

- Technical and regulatory assessments to identify and evaluate gaps.
- Consider existing requirements and Tier 1 safety enhancements.
- Assess insights from completed Tier 2&3 work.
- Use insights from previously completed analyses (e.g., MBDBE and CPRR evaluations).
- Use insights from previous Commission decisions.
- Maintain an appropriate level of technical rigor.
- Engage stakeholders if appropriate to finalize assessment of recommendation.



Resolution Groups

Group #1 – Can be closed now based on completed evaluations, progress made, and existing processes available to address future work.

Group #2 – Sufficient information available and staff's initial technical assessment complete; closure approach would benefit from interactions with ACRS/external stakeholders; work to be completed by March 2016.

Group #3 – 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.



Resolution Overview

- **Group 1 – Proposed to be Closed**
 - NTF Recommendation 3 – Seismically-Induced Fires and Floods
 - Additional Staff Recommendation – Basis of EPZ Size and Pre-Staging KI
 - NTF Recommendation 12.1 – ROP Modifications to Reflect Defense-in-Depth Framework
 - NTF Recommendation 12.2 – Staff Training on Severe Accidents and SAMGs
 - NTF Recommendations 9.3 (partial), 10.3c, 11.2, 11.4, and Those Subsumed into the MBD BE Rulemaking (Various EP Recommendations)
- **Group 2 – Additional Stakeholder Interactions Planned**
 - ACRS Recommendation – Reactor and Containment Instrumentation Enhancements for Beyond-Design-Basis Events
 - NTF Recommendation 5.2 – Vents for Other Containment Designs*
 - NTF Recommendation 6 – Hydrogen Control and Mitigation*
- **Group 3 – Further Assessment, Documentation, and Stakeholder Interaction Needed Before Closure**
 - NTF Recommendations 10.3a, 10.3b, and 11.3 – Remaining EP Activities
 - ACRS Recommendation/Appropriations Act – Evaluation of Other Natural Hazards
 - NTF Recommendation 2.2 – Periodic Reconfirmation of Natural Hazards*

*Remain under direct oversight of the JLD Steering Committee.



Seismically-Induced Fires and Floods (Group 1)

Background:

- NTTF Recommendation 3.
- Evaluate potential enhancements to prevent or mitigate seismically-induced fires and floods.
- Activity has a Tier 1 and a Tier 3 component.
 - Tier 1: Initiate development of a PRA methodology
 - Tier 3: Determine if regulatory action is needed

Current Status:

- Staff has been involved with PRA standards development organizations.
- The draft feasibility study for the PRA methodology is currently under review.



Seismically-Induced Fires and Floods (Group 1)

PRA Methodology Activities

- Initial project plan, July 2012 (ML12208A210 and ML121450222)
- Detailed SIFF Project Plan (in collaboration with BNL), August 2013
- Public Workshop on SIFF, December 2013 (ML14022A249)
- Draft SIFF PRA Feasibility Report, July 2015 (ML15195A428)
- Final SIFF PRA Feasibility Report – December 2015



Seismically-Induced Fires and Floods (Group 1)

- The feasibility study concluded that a phased- or graded- approach for estimating SIFF risk was preferable
 - Goal of PRA approach is to systematically identify SIFF accident sequences under which equipment would be required to function rather than quantifying SIFF risk
 - Use screening methods to eliminate low SIFF risk contributors
 - Perform plant walkdowns
 - Screen based on plant equipment characteristics and configuration
 - For ignition sources there was limited agreement among experts that some generic screening based on SSCs was possible. For internal flooding sources SSC based screening was not considered practical – rather use quantity of source fluid and availability of motive power
 - Perform more detailed analyses for more risk significant contributors.
 - May be able to build straightforwardly on existing seismic, fire, or flood PRAs to analyze selected scenarios



Seismically-Induced Fires and Floods (Group 1)

- The current “state-of-the-art” for SIFF is incomplete in several areas:
 - Probabilistically modeling and quantifying the risk to for multiple concurrent hazards
 - Lack of fragility data for seismically induced fires and floods
 - Adequate HRA accounting for concurrent events, different performance shaping factors, lack of access, etc.
 - Understanding the mechanisms of failure: e.g., when does a component catch fire, what is flow rate from a damaged tank
- Since the start of this effort, other organizations have been developing approaches to estimate SIFF risk (e.g., EPRI):
 - Based on currently available information these approaches are aligned with the findings of the feasibility study



Seismically-Induced Fires and Floods (Group 1)

- SIFF project activities lead to the conclusion that currently the technical challenges involved prevent PRA modeling and quantifying of SIFF scenarios with a level of confidence that is comparable to the “state-of-the-art” of current PRAs.
- Most of the PRA community seems to support a phased- or graded-approach for estimating the risk from SIFF and applying it to a pilot application.



Seismically-Induced Fires and Floods (Group 1)

- To finalize a graded PRA methodology, the following need to be addressed:
 - Plant-specific seismic, fire, and flooding models
 - Development of component seismic fragility data for fire and flooding
 - Pilot application to test and refine the method.
- Based on the feasibility study and related activities, it is concluded that finalization of the PRA methodology will require considerable time and resources.
 - Existing and post-Fukushima mitigation capabilities can adequately address SIFFs
 - Limited risk evaluations did not yet identify significant safety issues.



Seismically-Induced Fires and Floods (Group 1)

Final Assessment (Oct 2015) will discuss:

- Existing requirements for fire and flood protection.
- Post-Fukushima seismic walkdowns identified and corrected vulnerabilities.
- Safety enhancements associated with Tier 1 activities (e.g., EA-12-049) mitigate risks.
- Domestic and international operating experience.
- Integration of fire and flood response procedures would not represent a substantial safety enhancement.

Conclusion: Additional safety enhancements not necessary. Recommendation should be closed now. PRA feasibility study to be completed later this year.



Evaluation of Other Natural Hazards (Group 3)

Background:

- ACRS recommendation and included in Consolidated Appropriations Act for 2012.
- Initial plan followed same general process used for the Tier 1 hazard reevaluations (i.e., 50.54(f) letter).
- Prioritized as a Tier 2 activity because of the lack of critical skill sets for both NRC and nuclear industry.

Current Status:

- Staff is assessing how other external hazards will be addressed by mitigation strategies.
- This review is limited to only natural external hazards (consistent with Act and Steering Committee direction).



Proposed Steps for Other External Hazard Assessment (Group 3)

1. Define the population of natural hazards other than seismic and flooding to determine those hazards that should be reviewed generically (complete).
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.
4. Determine if additional actions are needed on a site- or hazard-specific basis.



Evaluation of Other Natural Hazards (Group 3)

Initial Assessment (Oct 2015) will include:

- Assessment of additional safety benefits from mitigation strategies relevant to other hazards.
- Discussion of available technical/environmental data (risk/frequency).
- Discussion of the expected hazards of primary concern.
- Discussion of plans to develop screening and assessment process for other hazards.

Final Assessment (Late 2016) will add:

- Previous supporting assessments (e.g., Generic Issues Program reviews, RIS on tornado missiles).
- Summary of protection under current requirements.
- Discussion of additional regulatory actions (if needed).
- Input from ACRS/external stakeholders.



Periodic Reconfirmation of Natural Hazards (Group 3)

Background:

- NTTF Recommendation 2.2.
- Initially proposed rulemaking to require licensees to confirm seismic and flooding hazards every 10 years.
- Prioritized as Tier 3 to be developed using insights gained from Tier 1 hazards reevaluations.
- Should also consider other natural hazards.

Current Status:

- Deferred pending completion of Tier 1 hazard reevaluations and Tier 2 evaluation of other hazards.



Periodic Reconfirmation of Natural Hazards (Group 3)

Initial assessment (Oct 2015) will include:

- Insights from Tier 1 and 2 hazard reevaluations to assess current processes.
- Discussion on existing processes and how new information is currently considered.
- Paper discusses that rulemaking is not viable.
- Staff plans to enhance internal programs to more proactively and systematically assess new hazard information.
- Program would leverage existing process.

Final Assessment (Late 2016) will add:

- Input from ACRS/external stakeholders.
- Complete actions to develop program.



Break

Vents for Other Containment Designs (Group 2)

Background:

- NTTF Recommendation 5.2.
- Prioritized as Tier 3 because issue needed further evaluation and insights from Tier 1 activities (Recommendations 4 and 5.1) to support a decision on possible regulatory action.
- Largely deferred pending work on EA-13-109 (Severe Accident Capable Vents for Mark I and Mark II Containments) and Containment Protection and Release Reduction (CPRR) rulemaking.



Vents for Other Containment Designs (Group 2)

Current Status:

- EA-13-109 implementation in progress.
 - Guidance issued
 - Phase 2 OIPs due by end of 2015
- Commission disapproved proceeding with CPRR rulemaking for Mark I and Mark II containments.
- Many related activities completed or ongoing.
 - Insights available from implementation of mitigating strategies
 - Insights available from Commission decisions on related matters (e.g., MBDBE and CPRR rulemakings)



Vents for Other Containment Designs (Group 2)

Initial Assessment (Oct 2015) includes:

- Significant information available from previous activities and analyses (e.g. CPIP, NUREG-1150, SOARCA).
- Available technical information, including analyses for EA-13-109 and CPRR draft regulatory basis.
- Discussion of related previous Commission decisions.
- Evaluations for each containment type.
- Initial conclusion: Further study is unlikely to demonstrate the need for regulatory action

Final Assessment (March 2016) will add:

- More detailed documentation of technical justification.
- Insights from ACRS/external stakeholders.



Hydrogen Control and Mitigation (Group 2)

Background:

- NTTF Recommendation 6.
- Prioritized as Tier 3 because of need for further evaluation and insights from Tier 1 activities to support a decision on possible regulatory action.
- Largely deferred pending work on EA-13-109, CPRR rulemaking, and international activities (including information on Fukushima accident sequences).



Hydrogen Control and Mitigation (Group 2)

Current Status:

- EA-13-109 planning/implementation in progress.
- Staff has participated in international activities related to hydrogen control practices.
- Many related activities completed or ongoing.
 - Insights available from Commission decisions on related matters (e.g., MBDBE and CPRR rulemakings)



Hydrogen Control and Mitigation (Group 2)

Initial Assessment (Oct 2015) will include:

- Significant information available from previous activities and analyses.
- Impact of existing regulations & mitigating strategies.
- Insights from CPRR analyses, SOARCA, international initiatives, and previous Commission decisions.
- Evaluations for each containment type.
- Assessment of potential migration of hydrogen to reactor buildings or other structures.
- Initial conclusion: Further study is unlikely to demonstrate the need for regulatory action.

Final Assessment (March 2016) will add:

- More detailed documentation of technical justification.
- Insights from ACRS/external stakeholders.



Evaluation of Other Containments and Hydrogen Control

Table 1
Recommendation 5.2 and 6 – Other Containment Designs and Hydrogen Control; Requirements and Practices

	Core Cooling Functions	Venting and/or Heat Removal for Containment Pressure Control		Other Containment Failure Modes and/or Core Debris Cooling	Release Reduction (Filtering)	Hydrogen Control	
		Pre-Core Damage	Severe Accident			Containment	Other
Mark I	EA-12-049 EA-13-109	EA-13-109 EA-12-049 EOPs FSGs	EA-13-109 SAMGs	EA-13-109 (CPRR)	N/A (CPRR)	EA-13-109 SAMGs	EA-13-109 SAMGs
Mark II	EA-12-049 EA-13-109	EA-13-109 EA-12-049 EOPs FSGs	EA-13-109 SAMGs	EA-13-109 (CPRR)	N/A (CPRR)	EA-13-109 SAMGs	EA-13-109 SAMGs
Mark III	EA-12-049	EA-12-049 EOPs FSGs	SAMGs	SAMGs	N/A (current assessment)	GSI-189 EA-12-049 SAMGs FSGs	GSI-189 EA-12-049 SAMGs FSGs
Ice Condenser	n/a	EOPs	SAMGs	SAMGs	N/A (current assessment)	GSI-189 EA-12-049 SAMGs FSGs	GSI-189 EA-12-049 SAMGs FSGs
Large Dry	n/a	EOPs	SAMGs	SAMGs	N/A (current assessment)	SAMGs	N/A (current assessment)

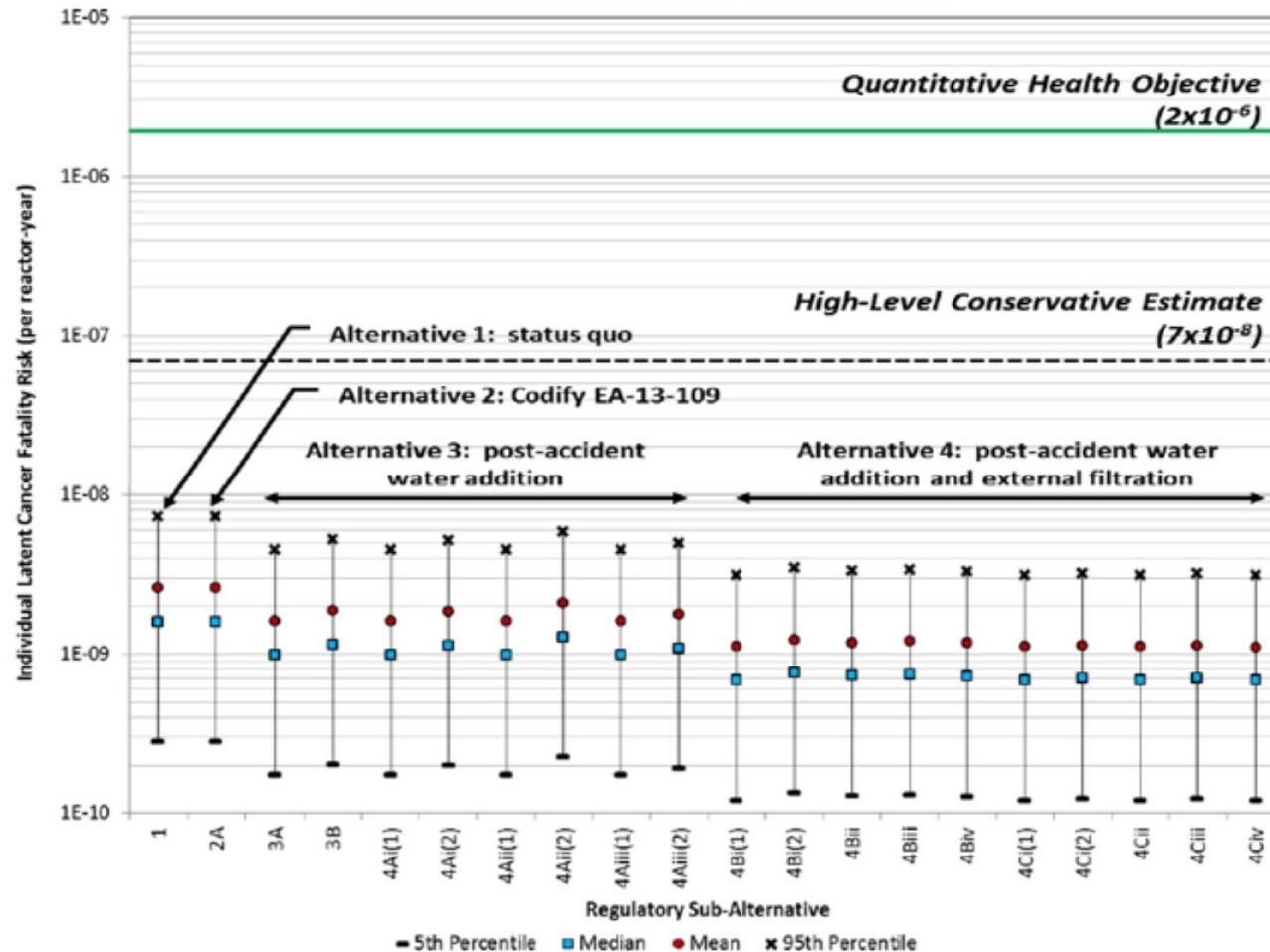
EA-12-049: Mitigation Strategies Order
EOPs: Emergency Operating Procedures
SAMGs: Severe accident management guidelines

EA-13-109: BWR Mark I/II Severe accident capable vent order
FSGs: FLEX (Mitigating Strategies) Support Guidelines
GSI-189: Generic Safety Issue re: Hydrogen Issues



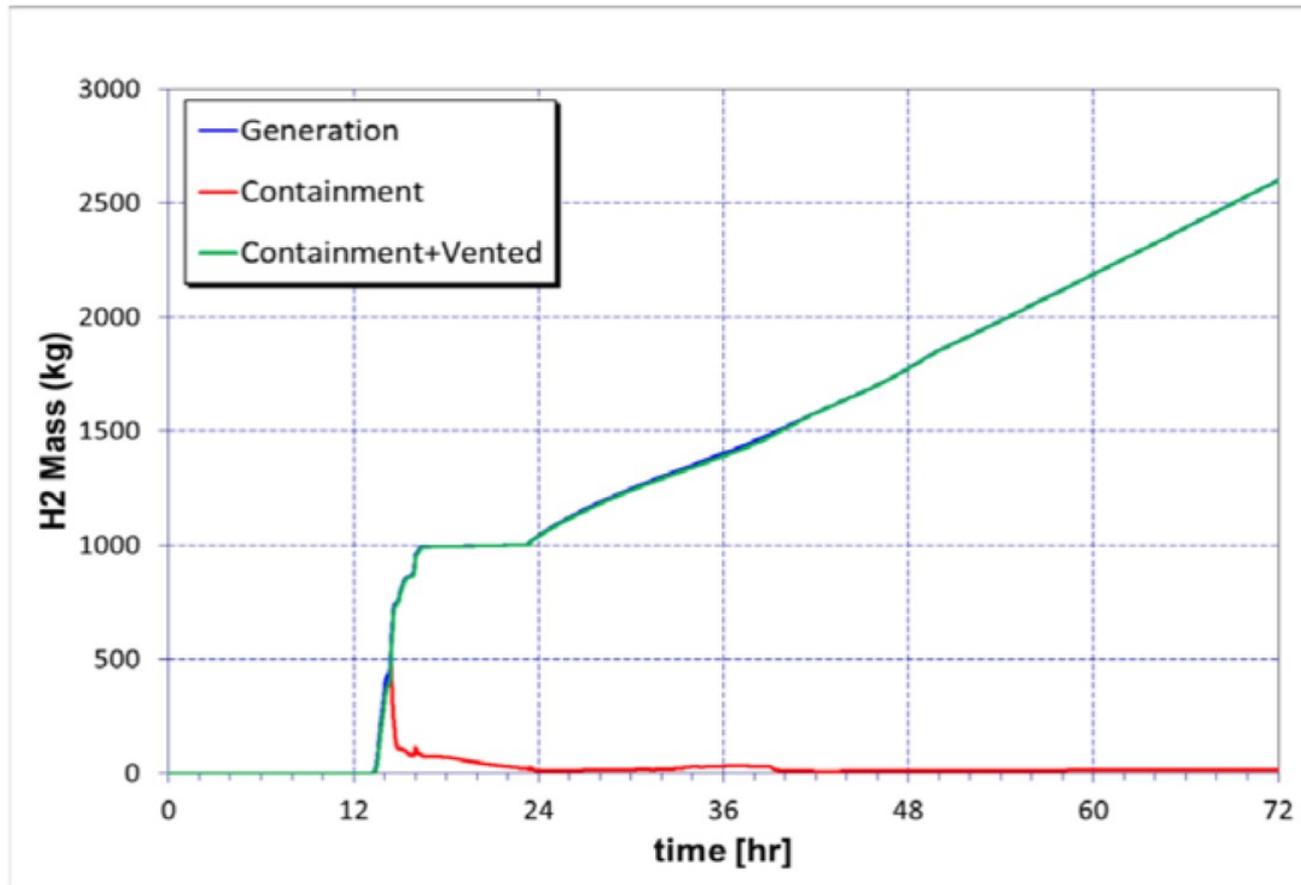
Mark I/II Containments (Order EA-13-109 & CPRR Rulemaking)

Figure 3-3: Uncertainty Bounds for Individual Latent Cancer Fatality Risk



Hydrogen Control for Mark I/II Containments

Figure 4-19: Mark I Hydrogen Generation and Transport for Case 9 (SAWA)



Containment Designs

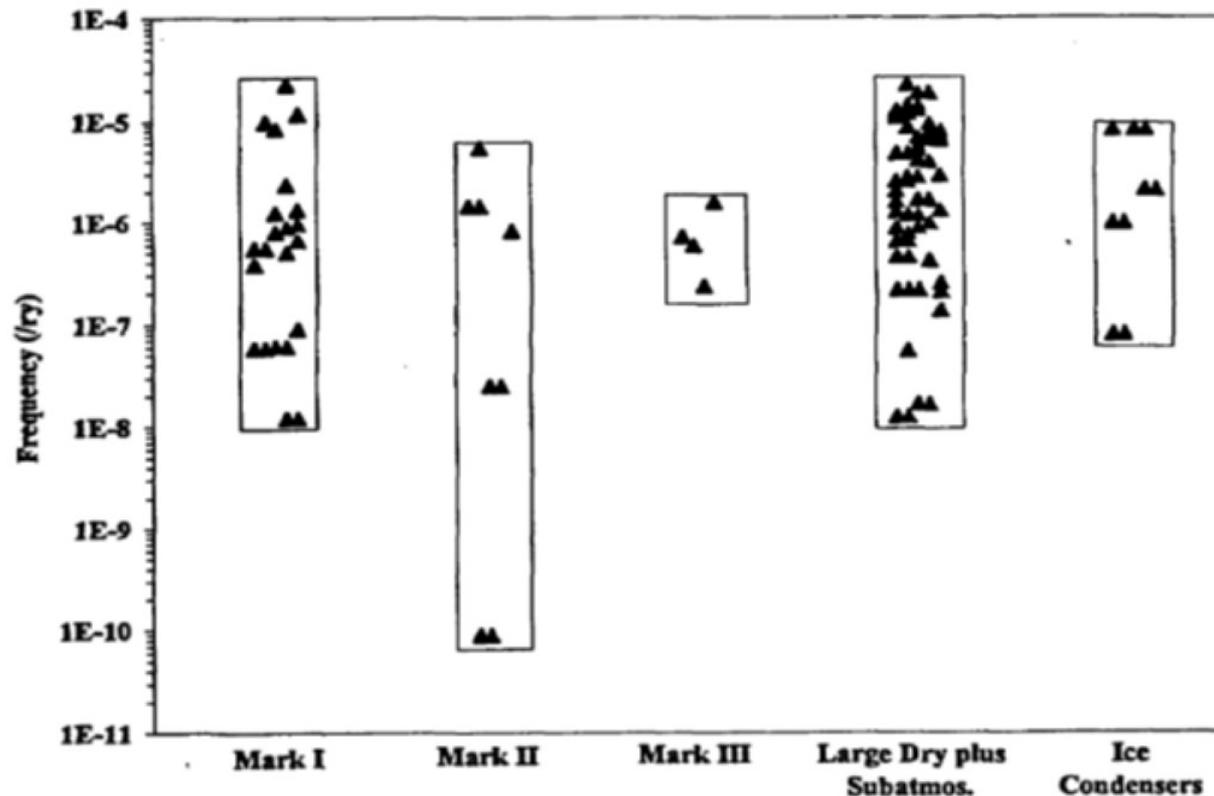
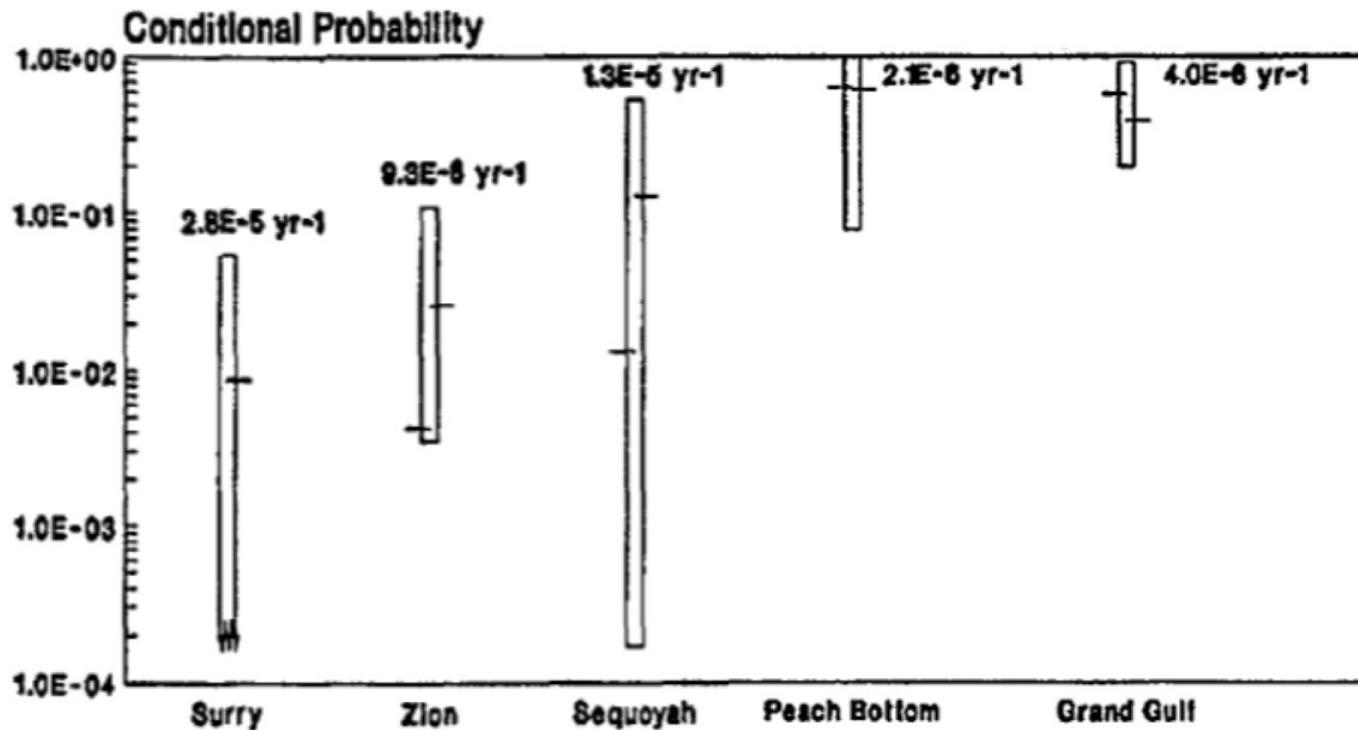


Figure E.3 Frequencies of significant early release (by containment type) as reported in the IPEs.

NUREG-1560, "Individual Plant Examination Program: Perspectives on Reactor Safety and Plant Performance"



Containment Designs



a. Station blackout

NUREG-1150 Conditional Containment Failure Probability
for Station Blackout



Mark III – Vents/Performance

- Core Cooling Functions
 - RCIC Dependence on Suppression Pool Addressed Within Mitigating Strategies
 - Restoration of Suppression Pool Cooling vs. Venting
- Containment Pressure Control
 - Pre-Core Damage: Mitigating Strategies
 - Post-Core Damage: SAMGs
- Other Containment Failure Modes/Debris Cooling
 - NUREG/CR-5529, An Assessment of BWR Mark III
 - NUREG-0933, NUREG-1150
- Release Reduction (e.g., engineered filters)



PWR Ice Condenser – Vents/Performance

- Core Cooling Functions
 - No Direct Dependence (for ELAP)
- Containment Pressure Control
 - Pre-Core Damage: Mitigating Strategies
 - Post-Core Damage: SAMGs
- Other Containment Failure Modes/Debris Cooling
 - NUREG/CR-6427, An Assessment of DCH Issues
 - CPIP, NUREG-1150
- Release Reduction (e.g., engineered filters)



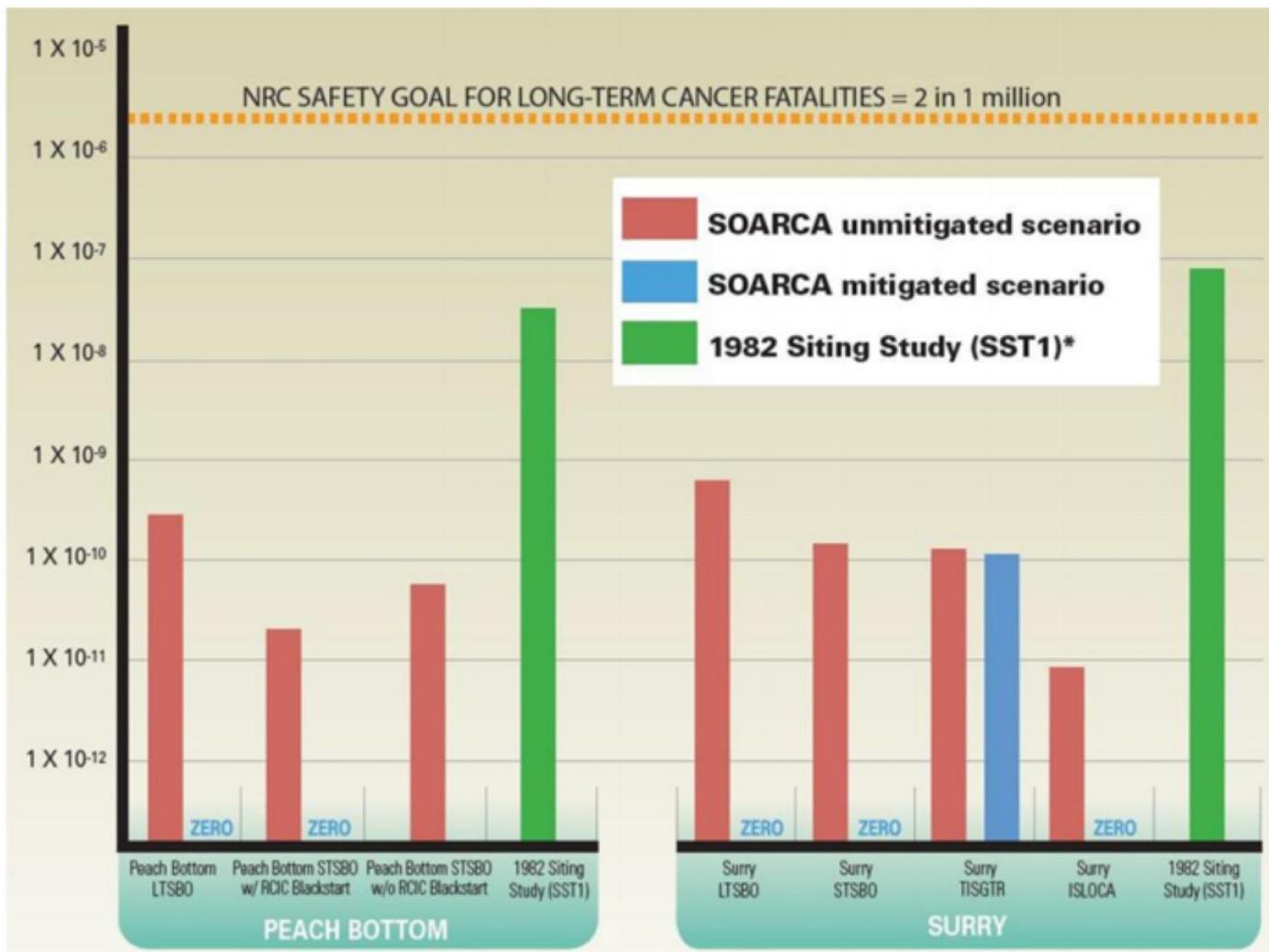
Mark III / Ice Condenser Hydrogen

- NUREG-1150
- NUREG/CR-6427, “An Assessment of DCH Issues for Plants with Ice Condenser Containments”
- GSI-189, Ice Condenser/Mark III Hydrogen
- Regulatory Commitments for Backup Power
- Order EA-12-049
 - NEI 12-06 Guidance



PWR Large Dry

Scenario-Specific Risk of LCF for an Individual within 10 miles assuming LNT (per reactor-year)



Project Plans

- Staff does not expect that regulatory actions beyond those taken are needed to close Recommendations 5.2 and 6
- Plans are to:
 - Interact with ACRS and external stakeholders
 - Develop final assessment
 - Provide paper to Commission by March 2016
- Absent new information from stakeholders, the staff expects these additional activities will support and provide further justification for the initial conclusion.



ROP Modifications to Reflect Defense-in-Depth Framework (Group 1)

Background:

- NTTF Recommendation 12.1.
- Expand ROP self-assessment and biennial ROP realignment to include defense-in-depth considerations.
- Tier 3 because it was dependent upon Recommendation 1.

Current Status:

- NTTF Recommendation 1 has been closed.
- Baseline Inspection Procedure Enhancement project has been identifying enhancements from Fukushima inspections.
- TI 2515/191 pilot has been completed; other inspections will occur in 2016 and 2017.



ROP Modifications to Reflect Defense-in-Depth Framework (Group 1)

Final assessment (Oct 2015) will discuss:

- Progress made to date on ROP enhancements (e.g. IP 71111.01, feedback from walkdowns).
- ROP self-assessment and realignment being enhanced following normal agency processes.
- Staff plans to use ROP Feedback Process to collect insights from Fukushima inspections.
- NRR/JLD, NRR/DIRS, and regions will work together to assess insights and enhance the ROP.
- Follow normal agency processes for future ROP enhancements (e.g., SAMG oversight).

Conclusion: Recommendation should be closed.



Break

Reactor and Containment Instrumentation for Beyond-Design-Basis Conditions (Group 2)

Background:

- Based on an ACRS recommendation to assess need to enhance reactor and containment instrumentation to survive beyond design basis events.
- Prioritized as Tier 3 because it required further staff study and depended on other Fukushima activities.
- ACRS Fukushima Subcommittee previously briefed on the topic on 9/16/14.

Current Status:

- Staff has interacted with domestic and international organizations on this subject.
- Staff analyzed related Tier 1 activities.
- Ongoing work to develop consensus standard for severe accident instrumentation.



Reactor and Containment Instrumentation for Beyond-Design-Basis Conditions (Group 2)

Process Used for Review:

- Key project activities from SECY-12-0095 broken into three tasks:
 1. Ensure licensees and NRC staff are appropriately considering instrumentation needs when implementing Tier 1 activities.
 2. Obtain and review information from previous and ongoing research efforts and coordinate with international and national stakeholders including industry standards organizations.
 3. Based on results of Task 1 and 2 determine if additional actions are needed.



Reactor and Containment Instrumentation for Beyond-Design-Basis Conditions (Group 2)

Process Used for Review:

- Task 1 results
 - Staff engaged in Tier 1 activities including:
 - Guidance development for Mitigating Strategies, Spent Fuel Pool Instrumentation, and Containment Vent Orders.
 - Supported MBDBE rulemaking.
- Task 2 results
 - Staff engaged with several national and international organizations including:
 - International Atomic Energy Agency
 - Institute of Electrical and Electronics Engineers
 - U.S. Department of Energy
 - Electric Power Research Institute



Reactor and Containment Instrumentation for Beyond-Design-Basis Conditions (Group 2)

Task 3 results – Operating Reactors:

- MBDBE staff requirements memorandum for SECY-15-0065 proposed rule:
 - Commission disapproved SAMGs as a requirement.
 - Not necessary for adequate protections of public health and safety.
 - Quantitative benefits not sufficient to show substantial safety benefit.
- MBDBE Order
 - Provisions to ensure key instrumentation is powered to demonstrate success of the strategies and to indicate imminent or actual core damage.



Reactor and Containment Instrumentation for Beyond-Design-Basis Conditions (Group 2)

Task 3 results – Operating Reactors (continued):

- Spent Fuel Pool and Containment Vent Orders
 - Includes expectations that instrumentation will work in the temperature, radiation, and humidity levels expected during the time such instrumentation is needed



Reactor and Containment Instrumentation for Beyond-Design-Basis Conditions (Group 2)

Task 3 results – Operating Reactors (continued):

- Review of national and international organizations work
 - IAEA Report NP-T-3.16 “Accident Monitoring Systems for Nuclear Power Plants”
 - Contains annex providing guidance for list of instrumentations and expectations that such instrumentation will work in severe accident environment
 - IEEE Standard 497, “IEEE Standard Criteria for Accident Monitoring Instrumentation for Nuclear Power Generating Stations”



Reactor and Containment Instrumentation for Beyond-Design-Basis Conditions (Group 2)

Task 3 results – Operating Reactors (continued):

- Staff plans to update RG 1.97, “Criteria for Accident Monitoring Instrumentation for Nuclear Power Plants
- Update based on IEEE Std. 497 update
 - Operating plants may use RG 1.97 update on a voluntary basis



Reactor and Containment Instrumentation for Beyond-Design-Basis Conditions (Group 2)

Task 3 results – New Reactors:

- Reviews of severe accident instrumentation including equipment survivability to continue based on Commission Policy
 - Based on Commission Policy Decisions in 1990s.
 - Mitigation features must be designed to provide reasonable assurance that they will operate in severe accident environments for the time span needed.
- Mitigating Strategies requirements to ensure key instrumentation remains powered during an extended loss of alternating current power



Reactor and Containment Instrumentation for Beyond-Design-Basis Conditions (Group 2)

Initial Assessment (Oct 2015) will include:

- Existing requirements for protection of instrumentation.
 - Insights gained from MBDBE rulemaking.
 - Insights from Spent Fuel Pool and Containment Vent Orders
 - A discussion on continued work on endorsement of industry standards (to be used voluntarily).
 - Interactions with national and international organizations.
 - A discussion on continued reviews on new reactor equipment survivability in accordance with policy.
 - Initial conclusion: Limited additional safety benefit; no further regulatory action needed.
- **Final Assessment (Mar 2016) will add:**
 - Input from ACRS/external stakeholders.



Staff Training on Severe Accidents and SAMGs (Group 1)

Background:

- NTTF Recommendation 12.2.
- Enhance internal training to include lessons learned.
- Provide training on SAMGs for resident inspectors.
- Prioritized as Tier 3 because it was dependent on the resolution of Recommendation 8 (subsumed into the MBDBE rulemaking).

Current Status:

- Severe accident training enhanced to include the lessons learned and accident information.
- SAMG training is being developed.
- Qualification program updates being evaluated.



Staff Training on Severe Accidents and SAMGs (Group 1)

Final Assessment (Oct 2015) will discuss:

- Establishment of periodic training seminars on severe accidents.
- Progress on developing SAMG training following normal agency processes.
- Work to update qualification programs.
- Upcoming internal communication to describe new training tools.

Conclusion: Recommendation should be closed.



Basis of EPZ Size and Pre-Staging KI Beyond 10 Miles (Group 1)

Background:

- Additional staff recommendation in SECY-11-0137.
- Staff planned to use the Level 3 PRA and the UNSCEAR assessment to reevaluate the EPZ basis.
- For KI, the staff planned to review information from Japan to consider policy changes.
- Prioritized as Tier 3 due to long-term studies.

Current Status:

- Some international reports are available and staff continues to follow Fukushima health studies.
- Information available to date supports existing regulations and policies on EPZ and KI.



Basis of EPZ Size and Pre-Staging KI Beyond 10 Miles (Group 1)

Final assessment (Oct 2015) will include:

- 2014 denial of rulemaking petition to amend EPZ size (PRM-50-104).
- Available information in support of current policies and practices.
- Assessment that EPZ size and practices related to KI are adequate.
- Evaluation of new information using existing processes.

Conclusion: No changes necessary to current EPZ size or KI distribution practices. Recommendation should be closed now.



Various Emergency Preparedness Activities

Background:

- NTF Recommendations 9, 10, and 11.
- Aspects include ERDS enhancements, public outreach/training, offsite radiation monitoring.
- Initial approach to collectively address these items using an advance notice of proposed rulemaking.
- Prioritized as Tier 3 due to unavailability of critical skills or required longer-term staff evaluation.

Current status:

- The staff has completed an evaluation of each recommendation and developed a resolution plan.
- Activities distributed between Groups 1 and 3.



Various Emergency Preparedness Activities (Group 1)

Final assessment (Oct 2015) will propose closure of items subsumed in the MBDBE rulemaking:

- Rec. 9.1, Initiate Rulemaking to Require EP Enhancements for Multiunit Events
- Rec. 9.2, Initiate Rulemaking to Require EP Enhancements for Prolonged Station Blackout
- Rec. 9.3 (Partial), Order licensees to perform various EP enhancements until rulemaking is complete
- Rec. 10.1, Analysis of Protective Equipment Requirements
- Rec. 10.2, Command and Control Structures
- Rec. 11.1, Enhanced Resources to Get Equipment Onsite



Various Emergency Preparedness Activities (Group 1)

Final assessment (Oct 2015) will recommend closure of the following additional EP recommendations:

- Rec. 9.3 (Partial), ERDS Enhancements
- Rec. 10.3c, Continuous ERDS Transmission
- Rec. 11.2, Evaluate Recovery and Reentry Insights from Fukushima
- Rec. 11.4, Training in the Local Community on Radiation, Radiation Safety, and the Use of KI

Conclusion: Recommendations should be closed now based previous assessments and progress made to date, including work with other Federal agencies.



Various Emergency Preparedness Activities (Group 3)

Initial assessment (Oct 2015) will discuss status of:

- Rec. 10.3a, Alternative Method for Transmitting ERDS
- Rec. 10.3b, ERDS Data Set
- Rec. 11.3, Efficacy of Real-Time Radiation Monitoring in EPZ and Onsite

Final Assessment (Late 2016) will provide:

- Details on additional efforts to determine basis for closure or recommended actions.
- A synopsis of work done in these areas.
- Understanding of ongoing efforts and existing processes.
- Input from ACRS/external stakeholders.



Next Steps

- Public Meeting with Industry's Steering Committee – Oct 20, 2015
- Commission Paper – Oct 30, 2015
- ACRS Full Committee – Nov 5, 2015
- Commission Meeting – Nov 17, 2015
- Focused Public/ACRS Meetings – As needed
- Progress/closeout to be provided in periodic update SECY papers



Summary

- October SECY paper will discuss specific deliverables, resource needs, and deadlines.
- Revised resolution approach will result in the Tier 2 and 3 assessments being completed earlier than originally planned.
- Additional engagement with stakeholders planned on Group 2 and 3 recommendations.
- Related activities will continue as part of existing agency processes.





U.S.NRC

UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment

Post-Fukushima Severe Accident Research

**Presented to the
ACRS Fukushima Subcommittee**

Richard Lee
Office of Nuclear Regulatory Research

October 6, 2015

Severe Accident Research Objectives

- Support agency risk-informed regulatory initiatives
- Address operating reactor emerging issues
- Provide new reactor licensing support
- Maintain severe accident phenomenological knowledge base and expertise
- Maintain validated analytical tools
- Maintain core knowledge of advanced reactor safety issues
- International collaborations (CSARP/MCAP, CSNI activities, IAEA and EU activities)

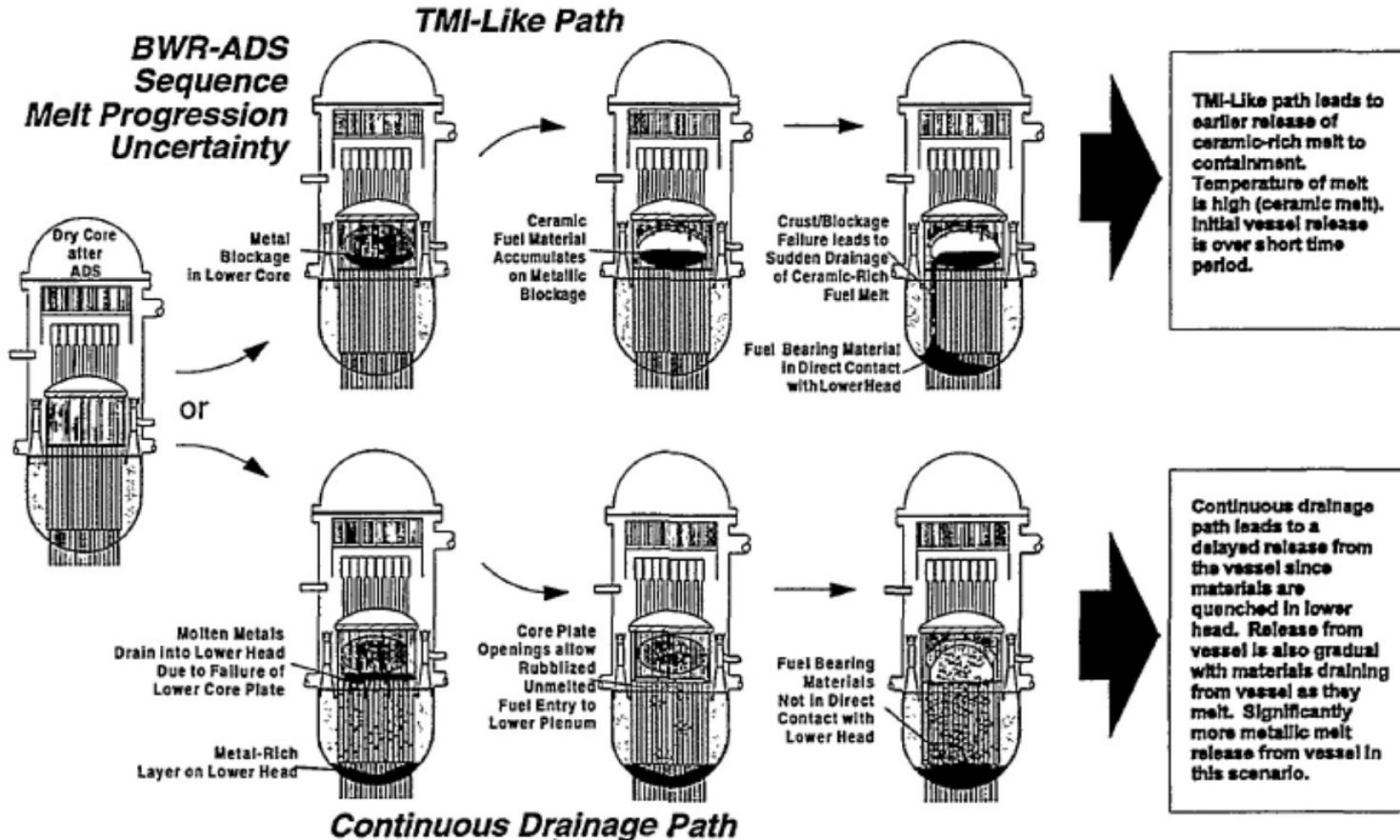
Post-Fukushima Research Needs

- **Phenomenological Research**
 - No fundamentally new severe accident phenomena identified for LWR technology
 - Some previously identified phenomena require additional attention
 - Melt progression, particularly late phase
 - Hydrogen risk
 - Ex-vessel melt behavior (coolability and FCI)
 - Fission products behavior in containment

Melt Progression

- **Relocation of molten core believed significantly different between BWR and PWR**
 - Molten pool formation in PWR
 - Melt collapse on support plate in BWR
 - Past experimental database more representative of PWR
- **Debris cooling in lower plenum**
 - Melt fragmentation and debris bed formation
 - Effect of salt (or raw) water on coolability

Is BWR Melt Progression Similar to PWR Melt Progression ?



Final Results of the
 XR2-1 BWR Metallic Melt
 Relocation Experiment

Hydrogen Behavior

- **Hydrogen generation sources and migration pattern**
 - Potential for stratification
 - Flammability consideration
- **Hydrogen combustion risk in vent path**
- **Hydrogen behavior in reactor building and spent fuel pool**
- **Assessment of hydrogen control measures**

Ex-Vessel Melt Behavior

- **Melt fragmentation and debris bed formation**
 - Effects of composition, temperature, and pour rate
- **Ex-vessel melt coolability**
 - Oxidic melt vs. mixed melt
 - Long-term core-concrete interaction
- **Energetic melt-water interaction**
 - Potential for stratified explosion

Fission Products Behavior

- **Fission products chemical forms**
 - Effect of salt (or raw) water
 - Aqueous source term
- **Fission products transport and retention**
 - Effect of salt (or raw) water
 - Leaching from submerged fuel
 - Pool scrubbing effectiveness

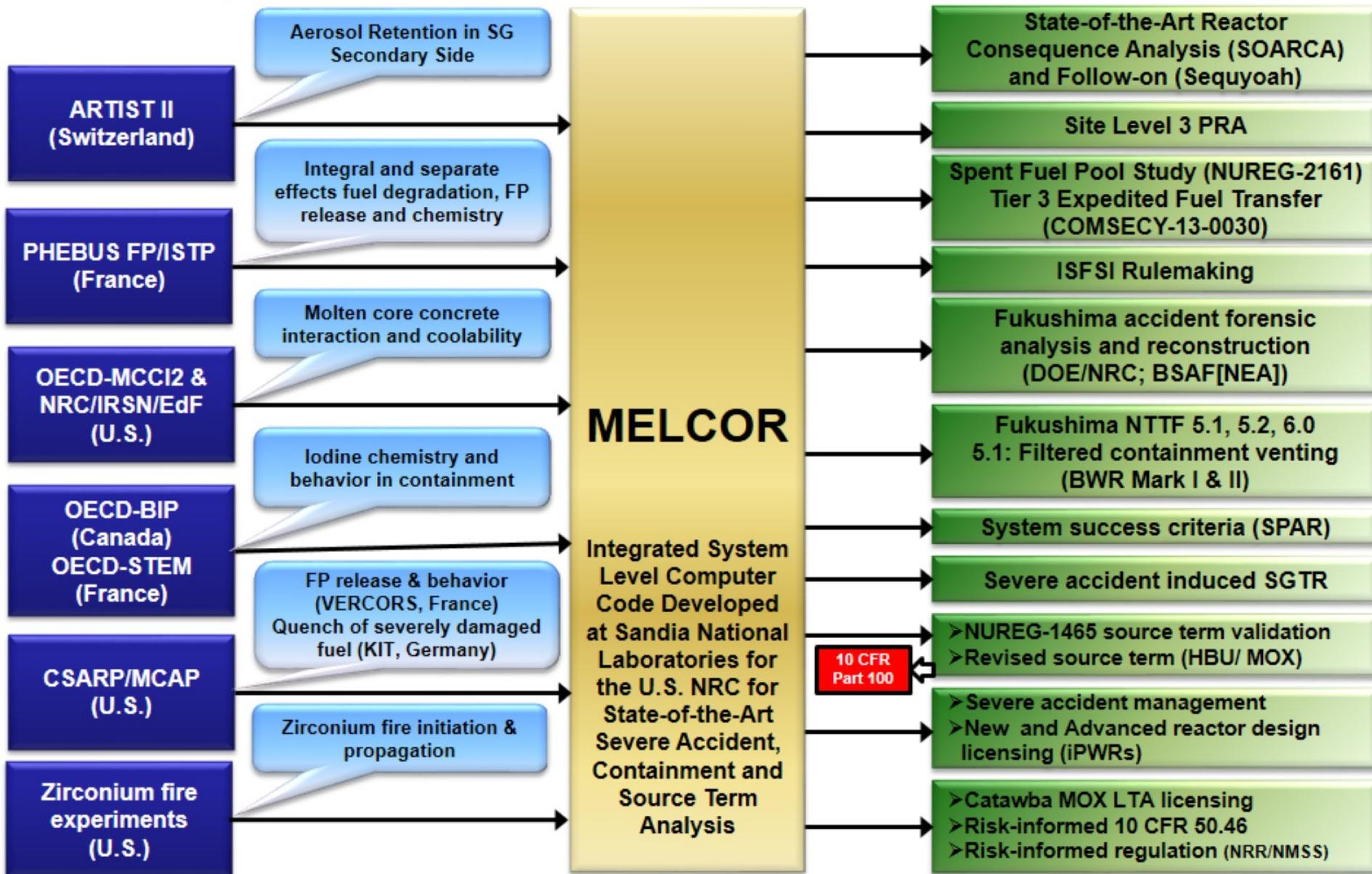
Improvement of Analysis Tools

- **Phenomenological modeling**
 - Late phase melt progression, melt quenching and fragmentation, melt spreading and debris coolability
 - Combustible gas transport and stratification
 - Fission product chemistry (aqueous iodine, ruthenium) and transport
 - Pool scrubbing under saturated condition
- **Mitigation system modeling**
 - Engineered safety features
 - Operator actions (EOP, FSG, SAMG)

Improvement of Code Numerics

- Retain same physics and basic equation set
- Revise code to improve stability and efficiency of explicit coupling and time integration
 - Introduce “temporal” filter on all flux rate terms
 - Improved and consistent treatment of “small value threshold” situations
- Revise code to cast all implicit equations (e.g. CVH-FL) in residual form
 - Enables use of Modern Solver libraries
 - Better separation of Computer Science from the Physics/Models

Regulatory Applications



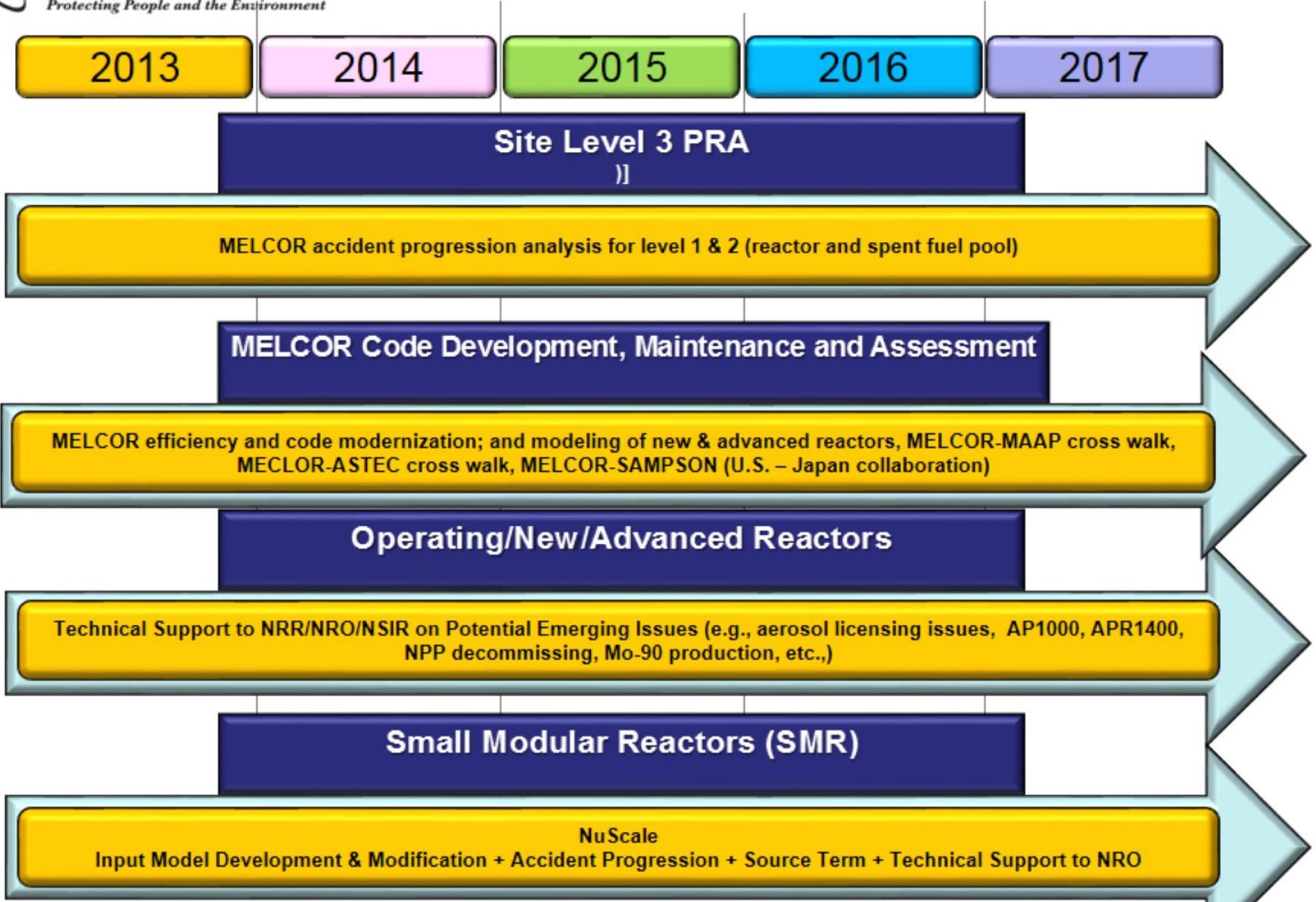
Treatment of Uncertainties

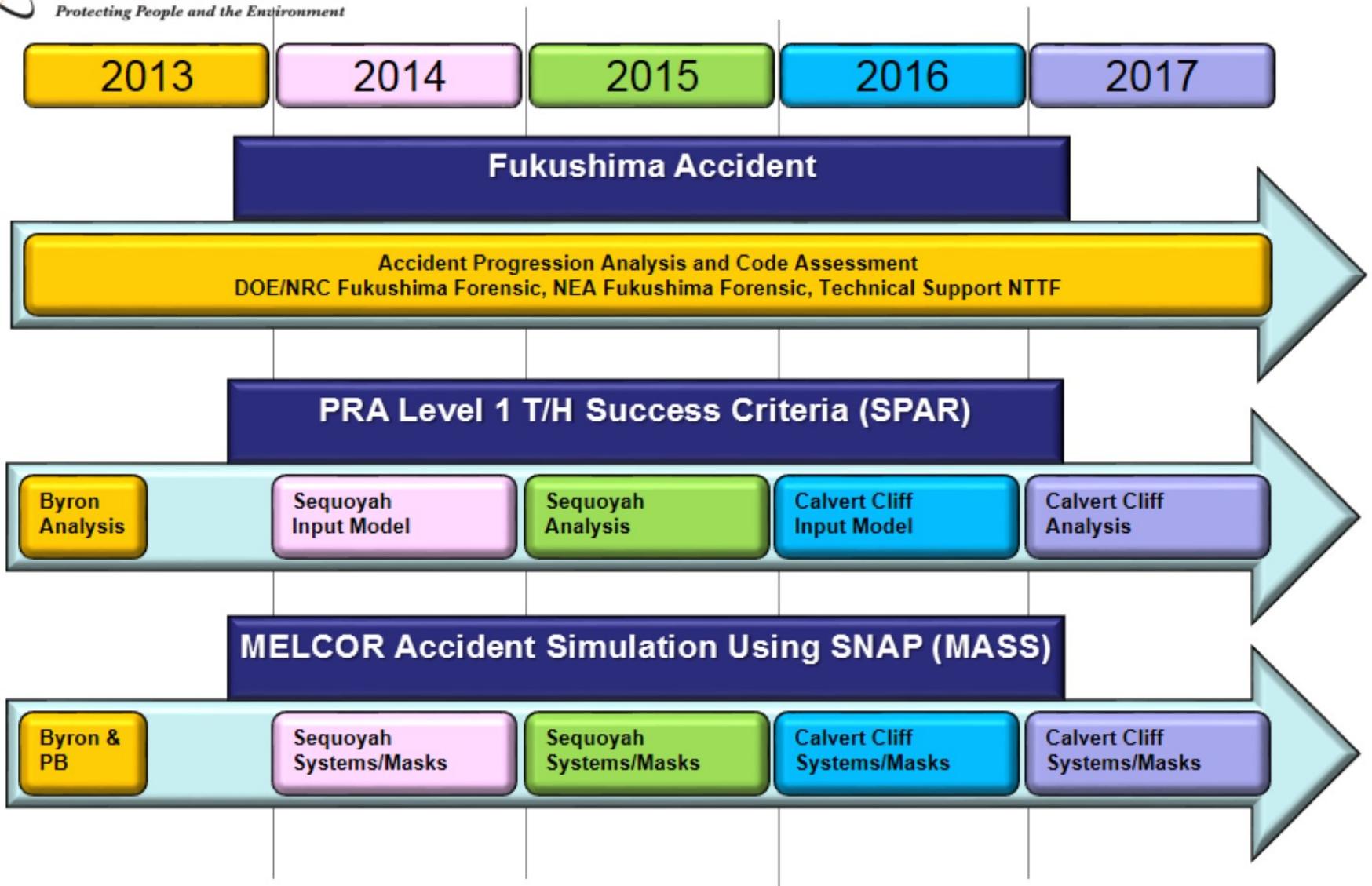
- **Knowledge (physics) uncertainties**
 - Role of phenomenological research
- **Modeling/parameter uncertainties**
 - Monte Carlo and LHS analyses
- **Data uncertainties**
 - Instrumentation reliability
- **Operator actions (EOP, SAMG)**
 - “Smart SAMGs,” simulators
 - HRA

Knowledge Management

- **Need**
 - Post-TMI thrust on accident prevention and SA issue resolution
 - Post-Fukushima thinking: balance between prevention and mitigation; R&D needs on mitigation
 - Much knowledge gained on severe accidents but workforce is ageing
 - Budget reality an incentive to R&D optimization and knowledge preservation
- **An approach**
 - Establishment of an academia-based center of excellence in severe accident research
 - Increased collaboration with international research

Severe Accident Activities





Severe Accident Activities (3)

2013 2014 2015 2016 2017

CSNI WGAMA

NEA CAPS: (1) Filtered containment venting, (2) Hydrogen, (3) SFP accident & mitigation strategies, (4) SAMG, .. Fukushima SAREF (led by Steve West), WGAMA Bureau and working group, BSAF Phase I & II

ISFSI Security Assessment

Technical support to NSIR & NMSS

Domestic and International SA research

IRSN and EC SA; CSNI-NEA- BIP I, II & III (Canada), STEM and STEM II (France), CEA VERDON (France), NRC-DOE-EPRI-EdF-IRSN on CCI testing at ANL (U.S.) , QUENCE at KIT (Germany); Collaboration with NRC-Japan on Fukushima related SA technical and cleanup efforts: Center of Excellence in SA (U.S.)

Conclusion and Challenges

Maintain the infrastructure to support agency severe accident analytical capability and Commission Strategic Plan

Challenges

- Resources
- Changing priorities
- Succession planning
- International research – objectives, cost and time-frame
- Implementation of agreements

Questions & Discussion

Post-Fukushima Tier 2/3 Issues

ACRS Fukushima Subcommittee

October 6, 2015



NUCLEAR ENERGY INSTITUTE

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Safety Improvements

- Large safety improvements for beyond design basis events through Tier 1 requirements
- The post-Fukushima Tier 2/3 issues should be closed with any residual questions moved into the NRC's regular processes
- Monitoring for new developments has always been standard practice

Overarching Lessons

- Provide cooling water and power under extreme conditions when station and off-site power are unavailable
- Retain or regain access to the ultimate heat sink
- Be prepared to handle multiple units affected by the same natural hazard
- As demonstrated at Fukushima Daini, portable equipment, high-quality site leadership, and dedicated personnel are the keys to success

Bias for Action

- Positioned for indefinite coping during an extended loss of AC power
- Compliance with NRC orders
 - Mitigating Strategies; substantial completion by end 2016
 - Spent Fuel Pool Instrumentation; full completion by end 2016
 - BWR hardened vent order; full completion by June 30, 2019
- Two national support centers in operation
 - Additional portable equipment within 24 hours
- Initial flooding and seismic walk-downs and assessments leading to final assessments
- Able to handle natural hazards affecting multiple reactors at same site

Going Forward

- Our lessons learned from Fukushima are substantial and on-going
- Success is optimal the industry and NRC are aligned with accountability for execution in both directions
- We will achieve significant safety benefit by those actions completed by the end of 2016
- The post-Fukushima Tier 2/3 issues should be closed with any residual questions moved into the NRC's regular processes