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UNITED STATES NUCLEAR REGULATORY COMMISSION'S

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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627TH MEETING

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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WEDNESDAY

SEPTEMBER 9, 2015

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ROCKVILLE, MARYLAND

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The Advisory Committee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B3, 11545 Rockville Pike, at 1:00 p.m., John W. Stetkar, Chairman, presiding.

COMMITTEE MEMBERS:

JOHN W. STETKAR, Chairman

DENNIS C. BLEY, Vice Chairman

RONALD G. BALLINGER, Member

SANJOY BANERJEE, Member

CHARLES H. BROWN, JR., Member

MICHAEL L. CORRADINI, Member-at-Large

DANA A. POWERS, Member

JOY REMPE, Member

PETER RICCARDELLA, Member
HAROLD B. RAY, Vice Chairman
STEPHEN P. SCHULTZ, Member
GORDON R. SKILLMAN, Member

DESIGNATED FEDERAL OFFICIAL:
Weidong Wang

ALSO PRESENT:
EDWIN M. HACKETT, ACRS
PHIL AMWAY, Exelon Corporation
JON BARR, RES/DSA/AAB
ROBERT BEALL, NRR/DPR/PRMB/PFLT
PAULA GOTSCH, Grandmothers, Mothers and More for Energy Safety *
JOHN GRUBB, Xcel Energy
PAUL GUNTER, Beyond Nuclear
STEVE KRAFT, NEI
MARY LAMPERT, Pilgrim Watch *
DAVID LOCHBAUM, Union of Concerned Scientists
ABY MOHSENI, NRR/DPR
ERIC OESTERLE, NRR/DPR/PRMB/PFLT
MARTY STUTZKE, RES/DRA
RICH WACHOWIAK, EPRI

* Present via telephone

C O N T E N T S

P R O C E E D I N G S

1:02 p.m.

CHAIRMAN STETKAR: The meeting will now come to order. This is the first day of the 627th meeting of the Advisory Committee on Reactor Safeguards.

During today's meeting, the Committee will consider the following: Review of Containment and Release Reduction, Discussion of Commission Meeting Topics, and Preparation of ACRS Reports.

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

We have received -- that's not correct. We have received several written comments and requests to make oral statements from members of the public regarding today's sessions. And we have time allocated for that process.

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

A transcript of the meeting -- portions f

the meeting is being kept. And it is requested that speakers use one of the microphones. Identify themselves and speak with sufficient clarity and volume so that they can be readily heard.

I also ask everybody to check your little phones and other communications devices. And please turn them off so we're not interrupted.

We will open the phone bridge line at the conclusion of this session on Containment Protection and Release Reduction, to be sure that we have comments from anyone who is listening in out there.

As an item of interested, I'd also like to note the passing of former ACRS Member Dr. Don Miller, who served on the Committee between 1995 and 1999. And we certainly recognized Don's tremendous contributions to nuclear safety throughout his career. We're sorry to hear about his passing.

With that, unless ay of the members have any other items for discussion, we'll turn to the first item on our agenda. Which is Review of the Containment Production and Release Reduction.

And Steve Schultz will lead us through that portion of the meeting. Steve?

MEMBER SCHULTZ: Thank you, John, for introducing the topic. Our ACRS Subcommittees on

Fukushima and on Reliability and PRA have met jointly to review this matter during two meetings in 2014, and on July 7 and August 18, this year.

During each of these meetings, we had the benefit of discussions with the NRC Staff, representatives of the Industry and the public.

Separately, this Committee has also been reviewing the related staff guidance and industry implementation of the response to the NRC Order EA-13109, which will ensure a severe accident capable venting systems in these facilities.

In our meetings in 2014, the Subcommittees reviewed the general concepts of the analysis and evaluation approach the staff intended to use in structuring the regulatory basis in its documentation.

In July and August this year, the Subcommittees have reviewed the detailed technical analysis work and evaluations performed by the staff which support this document. That is the document on Containment Protection and Release Reduction for BWR Mark I and Mark II containments. As well as the result in findings and recommendations.

We also heard presentations from industry representatives regarding their development and analysis of severe accident management approaches for

these facilities. And discussed these findings.

We discussed filtering strategies in severe accident management issues. And received comments from members of the public.

At our Subcommittee -- at our previous Subcommittee meeting on this subject, on August 18, we heard from staff and industry regarding their views. And are pleased to have them back today at this full Committee session to summarize their positions.

In addition, at this meeting, as John indicated, we will hear presentations from David Lochbaum of the Union of Concerned Scientists, Paul Gunter of Beyond Nuclear, and Mary Lampert of Pilgrim Watch on their views. And we'll also hear from any other interested members of the public who wish to make comments.

Following our August Subcommittee meeting, the Commission completed their deliberations on the matter. And decided not to proceed with Rulemaking Alternative 1 as described in the staff SECY paper. They provided clear direction to the staff to proceed accordingly.

Since the Commission has rendered their decision on this -- the alternatives that were presented by the staff, the Committee intends today to

focus on deliberations on the technical aspects of containment protection and release reduction for these facilities. With emphasis on the performance of severe accident capable venting systems and engineered filter systems.

We'll now proceed with the presentations. And I would like to invite Aby Mohseni of the staff to begin. Aby?

MR. MOHSENI: Thank you very much. Good afternoon Mr. Chairman and distinguished members. I am Aby Mohseni, Deputy Director for the Division of Policy and Rulemaking in NRR.

And we appreciate the opportunity to address the Committee today. The NRC staff is here today to provide a high level overview of the draft reg basis for the containment protection and release reduction rulemaking's CPRR.

The staff previously made detailed presentations on the CPRR rulemaking to the ACRS PRA and Fukushima Subcommittees on July 7 and August 18, 2015. And has benefitted from their feedback.

The NRC staff developed a Commission paper, SECY 15-0085 and a supporting draft regulatory basis that provides details on the high level conservative estimate and the benefits of external

water addition.

Since the last time we met with you, the Commission has provided direction to the staff in SRM SECY 15-0085 to discontinue the CPRR rulemaking activities, proceed with the implementation of Order EA-13-109. And use as applicable, the draft CPRR regulatory basis to support other near term task force Tier III items related to containment protection.

To start today's presentation, Bob Beall will provide an overview of the CPRR regulatory evaluation. Bob is the lead PM for the CPRR rulemaking in the Office of Reactor Regulations.

Next, Marty Stutzke from the Office of Nuclear Regulatory Research will briefly talk about the risk and PRA results in the draft CPRR regulatory basis. We also have John Barr from the Office of Research to answer questions as needed.

So now, let me turn it over to Bob.

MR. BEALL: Thank you, Aby. Good afternoon, gentlemen. I'd like to start on page two, slide two, by going over a background information on the overall Fukushima lessons learned.

CPRR rulemaking is just one part of a much larger NRC activity related to the lessons learned from the Fukushima accident. In this slide, we see a

number of the Fukushima activities that the NRC is looking at right now.

And if you look at towards the center or the upper center right portion of the slide, you can see where CPRR is. This says containment protection and release reduction rulemaking.

And it's also right next to the hardened vent order. Which is EA-13-10. But in addition to that, you also see there's a number of activities related to seismic and flooding activities with walk downs and reevaluations.

There's also onsite and offsite activities related to the FLEX equipment. And you also see there's emergency procedures and other activities like offsite blackout vents that's also part of the lessons learned.

So, CPRR is just on a facet of a much larger NRC activity related to the Fukushima lessons learned.

On the next slide, in the draft CPRR regulatory basis, the staff came up with four alternatives for the Commission to consider. They can be broken down into high level actions with related to containment protection and release reduction.

Alternatives 1, 2 and 3 are related to

containment protection. And Alternative 4 is release reduction.

Alternative 1 had to do with no rulemaking or maintain the status quo was going with, staying with the Order EA-13-109, which talks about over pressure protection. It also has a kind of a benefit of severe accident water addition to help cool core debris.

Alternative 2 had to do with codifying or making genetically applicable the Order. So basically we would take the Order EA-13-109 and add it to the regulations.

Alternative 3 was a combination of Alternatives 1 and 2, which is codifying the Order. But also require that the use of severe accident water addition or SAWA as part of the regulations.

MEMBER CORRADINI: So, can I ask? So, at this point, you're going to get to 4, which I know is different.

I'm still personally struggling about the difference between 1, 2, and 3. And I think that having the -- I asked this at the Subcommittee and I want to make sure that I've got it right in my head.

So is the difference between 1, 2, and 3 from a technical standpoint, no difference? And it's

more a process?

Or is there a technical difference between 1, 2, and 3? That's what I'm still struggling with.

MR. BEALL: There is really no technical difference between 1, 2 and 3. Because all three of them have the severe accident water addition as part of the regulatory evaluation.

MEMBER CORRADINI: Okay. And just to help me then, under Alternative 3, you note, and I think you guys noted this before in the Subcommittee about protection against major containment failure modes.

I don't appreciate what your pointing out there that makes it different. What does that mean?

MR. BEALL: The Order EA-13-109 was specifically written to address over-pressurization. But, when you add the addition of water, severe accident water addition, that also can apply to other containment failure modes like liner melt-through.

MEMBER CORRADINI: Sure.

MR. BEALL: Or, leakage through the drywall head.

MEMBER CORRADINI: Sure. But wouldn't that apply to 1 and 2?

MR. BEALL: It can. But it's not specifically called out like it would be in

Alternative 3.

When we would codify the Order plus requiring severe accident water addition, we could of -- we could actually -- we could also talk about protecting against alternative containment failure modes instead of just over-pressurization. Which is what the Order calls out for you to protect against.

CHAIRMAN STETKAR: Bob, let me --

MR. BEALL: It's a very subtle difference.

CHAIRMAN STETKAR: Let me see if I can understand it though. In principle, Alternative 2 and the Order, Alternative 2 simply codifying through rulemaking the Order, --

MR. BEALL: That's correct.

CHAIRMAN STETKAR: Could in principle, I'm not saying in practice. Could in principle be satisfied by someone designing a drywell vent with no water addition that would survive the condition in the drywell with no water addition?

Is that correct?

MR. BEALL: In principle that's correct.

CHAIRMAN STETKAR: Okay.

MR. BEALL: Because in Phase II of the Order allows you having a drywell vent operational.

CHAIRMAN STETKAR: And that's all that it

requires? Is a drywell vent that satisfies that function?

MR. BEALL: Right. Or you can have --

CHAIRMAN STETKAR: It has to be operational.

MR. BEALL: Right, it has to be operational.

CHAIRMAN STETKAR: And so I said, in principle, if I could design it with the right materials and environmental qualifications and reliability, that drywell vent with no water addition could satisfy either Alternative 1 or the codified version in Alternative 2.

MR. BEALL: Yes, sir, that is correct.

CHAIRMAN STETKAR: Okay. In Alternative 3, it actually adds the requirement for water addition.

VICE CHAIR BLEY: The reason why they say there's no technical difference, as I understand it, is because now you expect all the licensees to come in under any of the three with SAWA.

MR. BEALL: That's correct. Yes, sir.

VICE CHAIR BLEY: But --

MEMBER CORRADINI: Okay. But if I might just interject. So, technically, all three of them

except for the process by which the licensees would follow, technically would have the same effect under 1, 2, and 3. Unless I'm -- in practice.

Forget about principle for the moment.

MR. BEALL: Right.

MEMBER CORRADINI: From a practice standpoint, they would be practically the same. They are the same.

MR. BEALL: Right. So for like -- as John said, is that Alternative 1 and 2, you could come in --

MEMBER CORRADINI: Right, right, right. Okay. I'm with you there. I'm with you there.

CHAIRMAN STETKAR: That's why I tried to -- you're trying to see what is the distinction.

MEMBER CORRADINI: Yes.

CHAIRMAN STETKAR: And in my mind, that's -- it's a -- if you accept the fact that all of the licensees are going to satisfy the Order with water addition, then there is no distinction.

MEMBER CORRADINI: Okay.

CHAIRMAN STETKAR: But in principle, there could be.

MEMBER CORRADINI: Okay.

MR. BEALL: In Alternative 4, it's

classified under release reduction. And Alternative 4 it talks about using engineered filters and other filtering strategies to reduce your offsite release to through the vent.

In slide four, as Steve and Aby talked about, we have an SRM, all from the draft -- from the Commission on the draft regulatory basis.

The SRM instructed the staff to discontinue the CPRO rulemaking. And to not issue the draft regulatory basis for public comment.

They asked us to continue on with the Order EA-13-109 as written. And to implement it without additional -- any additional regulatory actions.

It also --

MEMBER CORRADINI: So if I might now, now we've got that technically they're all the same in prac -- potentially in practice.

MR. BEALL: Um-hum.

MEMBER CORRADINI: So from a process standpoint, what is the commitment under Alternative 1 by those licensees to follow the Order --

MR. BEALL: Right.

MEMBER CORRADINI: And SAWA or SAWM, whatever it is, would be part of that implementation

of the Order that would be --

MR. BEALL: That's correct. That's --

MEMBER CORRADINI: Expected and --

MR. BEALL: Yes, that's correct. That's Phase II of the Order.

MEMBER CORRADINI: Okay.

MR. BEALL: Right. Phase I of the Order talks about having an operable wetwell vent. And Phase II gives you the drywell vent. Or having a -- maintaining the wetwell vent in this direction.

MEMBER CORRADINI: Excellent. Thank you.

MR. BEALL: Yes, sir?

MEMBER BROWN: With the SAWA and stuff, when you originally did that Order, didn't -- I mean, we had a lot of extensive discussions on the water management and the water addition and all that stuff in the last meeting or two.

And but I don't remember that being talked about to that extent in the early Order. But so -- but it's still okay?

I mean it -- isn't this more of an industry initiative under the water addition stuff? As opposed to being a regulation?

Or, is the Order encompassing enough to get what we've heard in the last couple of meetings,

covered under the severe accident water addition and water management protocols that you all discussed with us?

MR. BEALL: The water is encompassing enough that they would -- it gives the licensees a choice. Okay? Under Phase II to the drywell vent, or have an alternative method to satisfy -- to maintain the wetwell vent.

MEMBER BROWN: So that's the wetwell vent issue then.

MR. BEALL: Right. That's right. That's correct.

MEMBER BROWN: So then the Order was explicit enough of that.

MR. BEALL: Yes, sir.

MEMBER BROWN: I guess I didn't understand that. Okay. Thank you.

MR. BEALL: Okay.

MEMBER CORRADINI: Sorry.

MR. BEALL: Go ahead.

MEMBER CORRADINI: I'm still not all the way there yet. So, under what the Commission is moving forward with, which is Alternative 1, Plant X says that here's how I'm going to satisfy Phase 1. Here I'm going to satisfy Phase II.

And in practice, part of Phase II is water addition and the associated management for days, weeks, of managing the water supply such that one has what they have -- so that they can vent. And then appropriately manage the water for coolability.

MR. BEALL: Correct.

MEMBER CORRADINI: Is that water addition strategy checkable by the staff? And if so, how is it going to be checkable?

MR. BEALL: I can't address that. That's prob --

MEMBER CORRADINI: I use the word checkable because anything else I use is probably illegally binding. I just want to know how are you going to check?

MR. BEALL: That's a question that would have to be answered by the folks in the JLD, who's managing the Order. You know, because I'm -- so I don't know how they're going to be checking that.

Because we didn't move it in that phase of the rulemaking to codify and come up with rule language and things like that.

MEMBER CORRADINI: Oh. But you're saying at this point, you hadn't anticipated that direction. So it's to be determined.

MR. BEALL: To be determined.

MEMBER CORRADINI: But it has to be checkable, right?

MR. BEALL: I assume it would be.

MEMBER CORRADINI: Okay.

MR. BEALL: But, that's a question for the --

CHAIRMAN STETKAR: But on -- I mean, the ability for the NRC staff to confirm that a licensee is satisfying their compliance with an Order, doesn't seem to be an issue specific item. Is it?

I think what we're asking is, if a licensee says I will comply with Order whatever, Order X. And by complying with Order X, I will do A, B and C. I don't care what those are.

Does the staff have a mechanism and a requirement to confirm that indeed that licensee is maintaining A and B and C?

MR. BEALL: The --

CHAIRMAN STETKAR: That's a process issue. It has nothing to do with severe accident water addition or anything.

MR. BEALL: Right. Right.

CHAIRMAN STETKAR: And a couple of us, I being one, don't know the answer to that question. I

think that's why we've raised it.

MEMBER CORRADINI: We're anticipating the answer is it's checkable. But, I just want to make sure that I understand. If 1 through 3 are approximately the same except for process, I'm trying to understand the process subtleties. That's all.

CHAIRMAN STETKAR: It's clear that if it's a rule, it's codified in the regulations.

MEMBER CORRADINI: Right.

CHAIRMAN STETKAR: And we know how those are treated. But what we're asking is, how is a licensee commitment to comply with an Order treated in a regulatory checkability -- thanks for the word, space.

MR. MOHSENI: It is the same. It has the same legal authority as the rules do. What you have in regulation, you have additional parts of the regulation that would kick in.

For example, there might be references to other parts of the regulation that generally adds more to the context of this rule. Whereas, in an Order, you only have what the Order says.

And the Order generally is more focused on what exactly it is that the Order is about. It does not reinvent all the other additional components that

are in a regulation that goes generally with a regulation.

And you don't have those benefits, flexibilities that the regulation offers sometimes. Exemptions for example.

CHAIRMAN STETKAR: Okay.

MR. MOHSENI: Where as an Order in fact is enforceable. And just as much as regulatory requirements are.

And because the number of plants affected by this thing, by this particular rule, are not expected to increase in future, hence an order seems to be an efficient way of actually capturing the essence that was intended to be captured in codifying the rule -- the Order.

MEMBER SCHULTZ: Aby, going back to the example that John gave, the simple one where the licensee had determined and committed -- committed as a result of the order to the staff that they are going to do A, B and C.

The staff then has the right and the responsibility to validate that A, B and C are in fact being accomplished going forward.

MR. MOHSENI: That's correct. There will be verification that in fact it satisfies the Order.

The Order isn't -- the Phase II of the Order says if you chose not to have a hardwell vent, you have to demonstrate why that is adequate for the protection of the containment.

In fact, this requires a subsequent analysis by NRC to approve the methodology that the licensees offer as meeting the Order.

So yes, there will be a schedule. There will be a time line for when NRC actually indicates that the Order is satisfied by each licensee.

CHAIRMAN STETKAR: Marty, that's for initial satisfaction of the Order itself. I today say that I will do A and B and C to satisfy this Order. The NRC reviews that and says yes indeed, we believe that if you do A and B and C, you will satisfy the Order.

What I think we're asking about in terms of checkability, is seven years from now, does the NRC have the ability to go to that licensee and check whether you still have the capability. Whether that's hardware or training or procedures or whatever, to indeed accomplish A and B and C.

That's the sense of checkability. Not the initial ability to meet the order. But continued ability throughout the life of the facility.

MR. BEALL: Like Aby said that, you know, it's almost like doing the rulemaking, codifying it. Except that, you know, it's an Order.

So, it should be able -- it should be falling under the ROP process for the site resident inspectors to look at the commitment. Making sure they're complying to commitment.

And having any site inspections as needed.

MEMBER POWERS: they can site against the commitment?

MR. BEALL: That's correct.

MEMBER CORRADINI: That's all we need.

MEMBER POWERS: They can site against commitment, then it's the same as a regulation.

MEMBER BROWN: Do you have the ability when they say they're going to do -- to use John's example, C. We will comply with C. They have to execute.

There's got to be a method to what they do. Here's how we're going to do it.

MR. BEALL: UM-hum.

MEMBER BROWN: Do you have the ability because it's an Order to be able to say, we don't agree with the way you're doing it. And you need to do it in a slightly different manner?

Or do you have to accept what they say because they say they're complying with the Order?

MR. BEALL: NO. We don't have to agree with that. We can --

MEMBER BROWN: You can get a change --

MR. BEALL: We can get a change.

MEMBER BROWN: To satisfy some -- so you're satisfied that they are in fact complying with the intent of the Order.

MR. BEALL: Yes, sir.

MEMBER BROWN: Okay.

MR. OESTERLE: Thank you. Eric Oesterle from the staff. I'm the team lead for the Fukushima Lessons Learned Rulemaking Team.

I just wanted to point out that once the licensees have provided their plans for compliance with the Order, that becomes part of the licensing basis. And compliance with the licensee's licensing basis is part of the normal inspection process that we go through.

And as Bob said, resident inspectors will routinely inspect those types of activities. In addition, the staff has already been working with industry on guidance for implementing the Orders.

And one thing that we've seen is that this

guidance has developed a template for implementing actions under Phase II. And they all include severe accident water additions.

So, that's one indicator that we have from industry, including our discussions with them here that all licensees are either going with severe accident water addition. Or any alternative has to be reviewed and approved by the NRC.

Later this years, I think by December, we expect all of the implementation plans from licensees for compliance with the Order. And that's when we'll get the, you know, the 100 percent verification that they're following, you know, the template that has been developed for implementing the Order in accordance with the ISG guidance document that's been developed.

So I just want to make the difference that it's not really a commitment that they're making here. They're complying with an Order that becomes part of their licensing basis.

MEMBER RICCARDELLA: Are there plant specific submittals? Or a general topical report submittal? Or some combination of the --

MR. BEALL: It would be plant specific.

MEMBER RICCARDELLA: Okay.

MR. BEALL: Okay. On slide five. And part of the draft regulatory basis that was submitted to the Commission, the technical analysis that's provided by the staff, supported all four alternatives.

That allowed the Commission to look over all the alternatives and all the data. And then come up with a -- their recommendation and direction they gave to the staff last month.

So, the -- but the technical analysis did demonstrate that the risk reduction from this -- that's shown in the risk reduction in the draft regulatory basis was not a substantial safety improvement.

Also, that the safety goal of the QHO, the Quantitative Health Objective limit of 2 times 10 to the minus 6, versus the CPRR high level conservative estimate that we calculated, was over an order of magnitude difference.

So, we were way below the NRC safety goal for that. And also the valuation and Marty will be talking about some of this stuff in a little bit, showed that, you know, we took advantage of the flex equipment, operator actions, probabilities and things like that and all that was all factored into the

analysis that the staff did.

And on slide six, I'd like to turn it over to Marty.

MR. STUTZKE: Good afternoon. Slide six shows an example risk calculation to try to remind all of us how these numbers are estimated like this.

Starting up at the top, when we began the analysis. We defined a variety of what are called sub-alternatives. And a sub-alternative is nothing more then a specific set of CPRR strategies.

For example, we'll consider a strategy that says gee, we're going to have severe accident water addition. And that water is going to go into the reactor vessel. And we will open the wetwell vent first. And an operator will do that as opposed to some rupture disk.

All of these different combinations. There's 20 sub-alternatives for -- defined, evolved as we continued to work on the process.

What's important to realize is that the strategies are -- or a sub-alternative specifies a capability or what is possible within the strategies. Probabilistically then, we treat it inside risk assessment and estimate the probability whether the strategy succeeds or fails.

So, looking a little bit down on there, you see a box called CDET. That is the Core Damage Event Tree. The notion is that we come in with an extended loss of A/C power as the initiating event to that tree.

That CDET then models the FLEX implementation probability through a variety of accident sequences. In reality, that CDET has 340 sequences of which 280 go to core damage.

So, it's rather lengthy that way. And this is where the approximate 40 percent reduction comes from, like this.

All of that is just to get started with the real purpose of our analysis, which is CPRR. Because we needed to establish the boundary and the initial conditions for the thermal hydraulics work.

And that's what the CDET provides us. So we group those sequences into what are called plant damage states. They are then fed into an APET or an Accident Progression Event Tree.

And out of the APET, what we get are release category frequencies that come out. And a release category defines a specific type of release. One that will happen, how much material is released. How much energy is associated with the release.

Things like this that we get out of MELCOR calculations that are then input to our max calculations for consequence. So the actual risk calculation per se, is this table.

So we have a variety of release categories for each sub-alternative. Their associated frequencies. We go through the thermohydraulics and the consequence calculations.

And John provides the conditional consequence. We simply multiply those two numbers together and add them up like this.

MEMBER BANERJEE: Does this take into account also the weather at its max?

MR. STUTZKE: Yes.

MEMBER BANERJEE: So that there's the -- but you take into account what weather class it is, the frequency of that. And that's all fed into this?

MR. BARR: All of -- this is Jon Barr. So, all of the conditional consequences are mean values over about 1,000 different weather trials.

And those are based on site specific weather for the reference point.

MEMBER BANERJEE: That was my question. Thank you.

MR. STUTZKE: Within the release category,

there's something subtle, because they are encoded. But it tells us how the material is escaping into the environment.

The middle column there, where you see the labels like WW or DW. That stands for venting through the wetwell or venting through the drywell.

If you scroll down the list a little bit, you see one called OP, over-pressurization failure of the containment. Meaning that none of the vents got opened in time. Okay, so that's an example of the containment failure mode.

The last column, IRV stands for in-vessel retention. LMT is liner melt-through. So, those are other additional containment failure mechanisms that come up.

What's important to realize is that within each sub-alternative or each risk calculation is there are different pathways for material to escape into the environment. And not all of those pathways are filterable.

In other words, if there's an over-pressurization failure, it doesn't go through the vent. And so putting a filter on the vent is not a benefit. The same way if there's a liner melt-through, that doesn't matter whether there's a filter

on the vent either.

So, we spent a great deal of time trying to track and understand the different ways that the containment was failing. So that when we apply a CPRR strategy to it, we're not over-crediting it or under-crediting it in the computation.

MEMBER RICCARDELLA: Excuse me. Why do some of the subcategories include drywell venting when I thought we weren't, you know, most of the SAWA strategies don't include a drywell vent.

MR. STUTZKE: Okay. When -- these strategies evolved over time. And one of the first strategies that came from our discussions was a so called passive drywell vent.

So we were going to put a rupture disk in there, not a valve. And it's like, okay, everybody's dead or they're incapacitated. And it will blow at the right time and therefore relieve the pressure.

So, that is one of the sub-alternatives. I can show it to you. The same way later on as the importance of water addition during severe accidents became obvious to us.

We defined flavors of that to SAWA, severe accident water addition, which is the pump just start it and let it run. And the whole containment would

fill up. As compared to a severe accident water management strategy that says throttle it and don't submerge the wetwell vent.

So, it truly -- I mean, on a personal note, we used to go to these meetings among ourselves and with industry. And I'd come back with three more sub-alternatives I would have to analyze. Of course by tomorrow. This sort of thing.

But, that's the nature of --

MEMBER POWERS: Maybe that should have been done before it was suggested.

CHAIRMAN STETKAR: Knowing Marty, he did. He just -- Marty, be careful with your paper there so you don't hit the mic.

Go back to the earlier slide. Because I want to make sure I don't -- I want to make sure I remember something from the full. Nope, not quite that early.

MR. STUTZKE: Not that early, right. I agree with that one.

CHAIRMAN STETKAR: There we go. This slide says that you indeed did model the operation of FLEX equipment to potentially prevent core damage. Right? And if it's correct.

If it prevented core damage, you didn't

have core damage. So that's what -- if it failed, then it remained -- did it remain failed for the post-core damage response?

MR. STUTZKE: It depends on how it failed.

CHAIRMAN STETKAR: Okay.

MR. STUTZKE: If the hardware itself failed, that was the end of it.

CHAIRMAN STETKAR: Okay.

MR. STUTZKE: Okay. If the operator failed to implement it in time, we did ask again, given more time, could they be successful?

CHAIRMAN STETKAR: Okay. So the operator's got a second chance if the hardware was available. But if the hardware failed -- you know, I recall there was also some timing issue related to core damage.

That if for example, RCIC failed early, you did not include credit for FLEX to prevent core damage.

MR. STUTZKE: Right.

CHAIRMAN STETKAR: Am I remembering that correctly?

MR. STUTZKE: That's correct. To add a little more confusion to the jargon, FLEX has Phase I and Phase II now.

CHAIRMAN STETKAR: Right. Yes.

MR. STUTZKE: As well as Phase III. Phase I is reliance on your in plant equipment. So, the logic structure says RCIC pump needs to work during Phase I.

CHAIRMAN STETKAR: Right.

MR. STUTZKE: Meanwhile, everybody's running around trying to install FLEX and drag the portable equipment out and this sort of thing like that. In this event tree, we assume that took a minimum of four hours.

CHAIRMAN STETKAR: So that if you lost RCIC early, you said you basically didn't have -- the operators essentially didn't have the early chance to save the core. They would still have the later chance.

MR. STUTZKE: Yes.

CHAIRMAN STETKAR: And because the hardware wasn't questioned. You questioned the hardware in the back part of the model?

MR. STUTZKE: That's correct.

CHAIRMAN STETKAR: Okay.

MEMBER BANERJEE: Could I also ask a question? MELCOR and -- yes, let's talk about MELCOR.

The calculations there, there's no

uncertainty in the results put on that in addition to anything?

MR. STUTZKE: Not that the MELCOR team did. I'll show you a slide and a couple back, where I tried to inform my understanding of the uncertainties by relying on the SOARCA uncertainty analysis work.

It's very --

MEMBER BANERJEE: Okay. I think that's --

MR. STUTZKE: Yes, it's a very current approach. But, yes.

MEMBER BANERJEE: At least it gives you a rough idea.

MR. STUTZKE: Okay. If nothing else, it demonstrates I pay attention to other research.

MEMBER BANERJEE: Right.

MR. STUTZKE: Okay. So slide number seven. Sorry John, I got to turn this page. I just need this, right.

Is trying to show the contributions to risk at a very high level. So I picked four sub-alternatives which are in the table below the graph.

And I apologize, the sub-alternatives have rather we'll say strong nomenclatures to how they're labeled. One --

CHAIRMAN STETKAR: Unintelligible is a different terminology.

MR. STUTZKE: And they would routinely change as the project evolved. Which I was going to say pulled my hair out, but I guess it's too late for that.

Like that, but I have tired to for this example, to summarize it. If you look in the lower right-hand corner, this is an example of a specification of part of a sub-alternative.

So we can talk about the water injection pathway. And here it says reactor pressure vessel. Another choice would be to the drywell directly.

The water strategy, whether it's SAWA versus SAWM. The venting priority, we're going to use the wetwell vent first, or we're going to try the drywell vent first. Vent control manual as opposed to a passive rupture disk.

And a venting strategy. An open and leave open strategy versus a vent cycling strategy. Where the vent would then be reclosed after the containment depressurizes by about ten pounds. Something like that.

So, for each of the cases you see here, all of these are the same so that we can do a fair

apples to apples comparison. In the first sub-alternative, there is no water addition capability and no filter.

All right. And you can see the risk. Total risk is about 3 times 10 to the minus 9 per reactor year like that.

MEMBER CORRADINI: What is the horizontal access? Time?

MR. STUTZKE: No. The horizontal access is just showing you the different cases.

MEMBER CORRADINI: Between 3 and 4, okay.

MR. STUTZKE: Right. So, moving over to the column of 3(a), we now allow water addition capability with its associated success or failure probabilities in there.

And I'll call your attention to the green line, which is the third down from the top. And it has increased. That's actually the desired or the preferred response.

Now, corresponding to a case where the containment is in fact vented. And core debris is being retained because water addition has been successful.

If you'll look at the black line, which is the total risk. So you can see that the inclusion of

a water addition capability does lower the risk somewhat.

Moving over to the third column. Now we add in the possibility of a filter on the containment vent line. In this case the decontamination factor was assumed to be 10.

This is a parametric study. It's not as if we say they can actually achieve a DF of 10. It's just want if it was 10.

And you can see the risk is lowered somewhat. But it's not totally eliminated. And that's because as I'd said before, not all the release pathways are in fact filterable to that vent line.

Then when one increases the DF up to 1,000, assuming that's possible, you don't see much change in the total risk at all.

MEMBER CORRADINI: So, it's all the leakage around it?

MR. STUTZKE: It's the cases where things like the SAWA capacity doesn't work. So they get a liner melt-through.

MEMBER CORRADINI: Ah.

MR. STUTZKE: Okay.

MEMBER CORRADINI: So it's not that it's working. But it's bypassing. It's a combination of

a whole bunch of failures.

MR. STUTZKE: That's correct.

MEMBER BANERJEE: Are these changes significant within the uncertainties?

MR. STUTZKE: You must have read my slides.

(Laughter)

MEMBER BANERJEE: I guessed again.

MR. STUTZKE: Yes. Next slides -- next slide.

VICE CHAIR BLEY: Do look at that left-hand scale. There's not a lot of change.

MEMBER BANERJEE: That's what it means.

CHAIRMAN STETKAR: This is a linear scale in 5E to the minus 10 increments. This is --

MEMBER BANERJEE: Yes. And that's why I asked it.

CHAIRMAN STETKAR: Now, something that looks like a factor of 2 on a really small number.

MEMBER BANERJEE: And with very large uncertainties.

MR. STUTZKE: Correct. If you flip to slide number eight.

MEMBER SCHULTZ: Before we go Marty.

MR. STUTZKE: Yes?

MEMBER SCHULTZ: So, what you're saying is for the cases on the right-hand side where filtration comes into play, for some period of time the pathway to the filter is functional?

MR. STUTZKE: No. Remember this is a compilation of many sequences. So --

MEMBER SCHULTZ: Many sequences. Okay.

MR. STUTZKE: In some cases the sequence is such that there's no venting at all. So you get an over-pressurization failure, which is not filtered.

Okay. So this is results of all of the sequences summed together.

MEMBER SCHULTZ: So it's a combination of possibilities --

MR. STUTZKE: Correct.

MEMBER SCHULTZ: That are represented by the point result.

MR. STUTZKE: Correct. Yes, it's not a specific sequence.

MEMBER SCHULTZ: But that could be an outcome. In other words that could be an outcome where the pathway, the venting pathway to the filter is functional. But then the containment fails or the liner melts through and at that point, it releases through that pathway.

MR. STUTZKE: That's correct.

MEMBER SCHULTZ: Okay. Thank you.

MR. STUTZKE: Okay. This slide shows the comparison of the risk results to the NRC's safety goal. And I think the -- let's try to review this from the bottom up because it answers Dr. Banerjee's question.

And that is, the 20 regulatory sub-alternatives are shown displayed across there with their uncertainty bounds on there. Those uncertainty bounds include the uncertainty in the seismic hazard curves, the seismic fragility, the equipment reliability, the operator reliability, and simplistically in the consequence that we got out of MACCS.

And the consequence uncertainty was then formed by SOARCA. But it's very simple. It's just a log normal variable on top of it.

But it provides some idea of as you say, if you look at the change in the red dots, which are the mean values on this. On the previous side, you see a reduction of 50 percent.

But the uncertainty band was well over an order of magnitude. Most of that being driven by the uncertainty in the seismic hazard curve itself, like

that.

Working up at the --

CHAIRMAN STETKAR: But that uncertainty though is a constant for all of these?

MR. STUTZKE: That is correct.

CHAIRMAN STETKAR: Yes. So it's -- I'm just thinking, we've not seen --

MR. STUTZKE: The other thing to remember that makes it a little bit more confusing is what you're looking at is a fleet average risk here. Averaged over all the BWR Mark I and Mark II plants.

And they all have their own uncertainties in the seismic hazard curves because those were site specific. Okay. So you really begin to -- and those were propagated through the trees for the -- but it gets difficult then to begin to interpret the result.

MEMBER BANERJEE: How much of that is the seismic part?

MR. STUTZKE: Most of it.

MEMBER BANERJEE: Most of it. So, if you took the seismic out, it would just be a much smaller incident.

MR. STUTZKE: That's correct.

CHAIRMAN STETKAR: You did say that there is -- you characterized this simplistic. There's just

a log number distribution. But, you mentioned it and I think we did discuss it a little bit at the Subcommittee.

There is some characterization in the MACCS part of the process in here. I mean, it's small compared to the seismic hazard I think you explained. But there is something in there.

MR. STUTZKE: It's there. On Table -- on the Table on slide six. What we're talking about is the conditional consequence. I treated that as a mean value.

CHAIRMAN STETKAR: Um-hum.

MR. STUTZKE: And I put a parametric uncertainty around it, log normal.

CHAIRMAN STETKAR: Okay.

MR. STUTZKE: And I mean, I can tell you, the air factor was set to 10 because that's what we were seeing out of the SOARCA uncertainty.

CHAIRMAN STETKAR: But it was set to ten? Which is a reasonableness. Okay.

MR. STUTZKE: Yes.

CHAIRMAN STETKAR: Okay.

MR. STUTZKE: Moving up the side, I've tried to put some arrows in here that group the sub-alternatives by the SECY paper alternatives. Stating

on the left-hand side, you'll see there's two sub-alternatives where we consider only the severe accident capable event.

No first accident water addition capability or no external filtration. Then we have a block there labeled alternatives one, two and three, that do include the water addition. And alternative four is water addition plus filtration.

This goes back to the kind of evolving nature of how the calculation is done. Dr. Corradini will probably realize, this has been relabeled, then what we showed at the subcommittee meeting in response to your question.

Okay. When we started the analysis, the assumption was as laid out in the SRM to SECY 12-0157 that said, assume you have a severe accident capable vent and go from there.

So, we did just that. It didn't occur until later that it wasn't physically possible to design that vent without water addition capability.

So the first two bars are like -- the first two sub-alternatives are as if you have I think of it like a super vent. It doesn't need water addition in order to be used.

So, the materials are right. And it can

just vent when it needs to vent.

The next block of alternatives, adding the water addition capability, is done. The presumption was, it was being done to prevent liner melt-through. Another important containment failure mode.

Retroactively, it turns out well, you need in order to practically design the vent, you need the water addition.

MEMBER CORRADINI: So, my question was, now there's various ways to look at this figure since it's got so much information on it.

But, the previous one, if you can go back just one click. So, the black line under 3(a), now go forward, 3(a) and 4(b), is where? That black line is the red or the blue?

MR. STUTZKE: That black line is the red dots.

MEMBER CORRADINI: The red dots. Okay. Are the red dots. And the uncertainty from site -- I'm just trying to try to remember all this. The uncertainty and seismic dominates the range.

But if I'm going to have a very bad day, I'm going to have a very bad day within a factor of 2 regardless.

MR. STUTZKE: That's correct.

MEMBER CORRADINI: Even --

MR. STUTZKE: If I under --

CHAIRMAN STETKAR: On a mean value, it depends on what you call a very bad day.

MEMBER CORRADINI: And my point is, if you're --

CHAIRMAN STETKAR: If you're at the 95th percentile confidence in terms of what you characterize as a very bad day, in terms of what is the 95th percentile of the frequency of a damaging earthquake, I mean, you could interpret that as looking at the patter of the black Xs at the top.

MEMBER CORRADINI: Right. But you're looking at how --

CHAIRMAN STETKAR: And so how you characterize a very bad day, it depends on --

MEMBER CORRADINI: But there's still a factor of 2.

CHAIRMAN STETKAR: It's a factor of 2 delta on the black Xs. That's right. Okay.

MEMBER CORRADINI: That's what I'm trying to get at. Okay.

CHAIRMAN STETKAR: Right.

MR. STUTZKE: The other thing you need to remember is when you're making a comparison to the

safety goal that's supposed to be done on the mean value. Not the other percentiles.

MEMBER CORRADINI: But I'm sure we're going to have other speakers that are going to argue about that. So I don't want to argue about that right now.

I just want to say that if I had the Y axis with no numbers, but the relative spacing of them had meaning, there's really not a lot of movement between them however I try to start managing the acts -- the consequences. That's what I'm --

MR. STUTZKE: I think that's a fair characterization.

CHAIRMAN STETKAR: If the first two -- I think Marty, what you were saying though, is if that first two were quantified without a vent, which is what you're saying, you couldn't really design it. You assumed it was a --

MR. STUTZKE: Right.

CHAIRMAN STETKAR: A magic vent.

MR. STUTZKE: Exactly.

CHAIRMAN STETKAR: The mean values there, the red dots on those first two bars, would certainly be higher then where they are. Would they be as high as your high level conservative estimate?

MR. STUTZKE: I don't think so.

CHAIRMAN STETKAR: Okay.

MR. STUTZKE: I mean, we obviously, we didn't quantify it since the Commission instructed us to assume that you have the vent.

CHAIRMAN STETKAR: Yes.

MR. STUTZKE: It might help to review how that -- what that high level conservative estimate means. Or how it was derived.

CHAIRMAN STETKAR: Could you do that?

MR. STUTZKE: Yes. Let me do that now.

MEMBER SCHULTZ: Before you do that though Marty, I just -- I mean, we're focusing as I think we did on the Subcommittee on the first two points. First two cases on the left.

But, we know what we're going to hear from industry. And that is in order for them to implement the Order, they're going to talk about severe accident capable vents with post accident water addition.

CHAIRMAN STETKAR: I was just trying to get a -- since we're arguing about the --

MEMBER SCHULTZ: No, I got it. I actually --

CHAIRMAN STETKAR: Fact that there are two alternatives.

MEMBER SCHULTZ: No, I understand.

CHAIRMAN STETKAR: As we go, two alternatives, one, two, three and four.

MEMBER SCHULTZ: Right.

CHAIRMAN STETKAR: I'm just trying to get a sense of how big the delta in the opposite direction would be if we did not have venting capability.

MEMBER SCHULTZ: Correct. Okay. Yes, I'm fine with that.

CHAIRMAN STETKAR: Do you follow me? How big is that delta?

MEMBER SCHULTZ: I just want to provide the perspective to the Committee on the discussion content.

CHAIRMAN STETKAR: And that gets us to how they've defined that high level conservative.

MEMBER RICCARDELLA: A question on your 95th percentile. Does that include the variability from plant to plant? Or is that 95th percentile uncertainty on the mean?

MR. STUTZKE: On the means.

MEMBER RICCARDELLA: So, you could conceivably get a plant that's --

MR. STUTZKE: That could be an outlier plant.

MEMBER RICCARDELLA: Ultimately, are we going to get plant specific information of this type? I mean, this brings to mind that, you know, the statistician who drowned in a river with an average depth of six inches.

MR. STUTZKE: Yes. Now, I don't believe that we will have this on a plant specific basis from licensees.

MEMBER RICCARDELLA: But don't we need to have some understanding of how bad a worse case plant could be relative to the mean?

MR. STUTZKE: Well, the whole strategy of the argument here, and looking at the fleet-wide mean, is to convince yourself on the average, everything is okay.

Remember, we're not after to estimate the risk of any specific plant. What we're trying to show you is, we think the risk is reasonably below some regulatory limit.

And that lets you do -- simplify the computations somewhat.

MEMBER RICCARDELLA: I understand.

MR. STUTZKE: So, the real question is, even though, you know, if I picked my black Xs, the 95th percentile of the mean, and you ask, well, how

bad could it really be?

MEMBER RICCARDELLA: At the worst plant.

MR. STUTZKE: At the worst plant. That's what the high level conservative estimate attempts to address.

MEMBER RICCARDELLA: Okay.

MR. STUTZKE: And that high level conservative estimate was, we went through the results. Well, let me remind the Committee, and perhaps the full Committee hasn't heard this story.

Was, when we had presented to the Subcommittee a while back, there were valid concerns about the human reliability. The ability of the operators to function.

It's a very complicated problem to estimate those probabilities. Especially post-core damage.

So, I started thinking about it and said look. If I just take the highest ELAP frequency across the fleet, not the average, but the worst one that I got. And I multiply it times the worst condition or consequence that John calculated for me.

That number is well below the safety goal. More then an order of magnitude below the safety goal.

MEMBER CORRADINI: Well even if you took

the worst of those?

MR. STUTZKE: Correct.

MEMBER CORRADINI: Regardless of location?

MR. STUTZKE: Correct. But, remember his calculations are for a generic site I believe.

MR. BARR: The MACCS calculations were for a referenced Mark I site, which was Peach Bottom. In the sensitivities that we looked at that went into the high level conservative estimate, there were some other sites used for population, distribution and economic values there. Thank you.

MR. STUTZKE: Yes. And the frequency site is, of course, site specific. Like that. But the flavor of it is, give no credit whatsoever for any CPRR strategy at this point.

Everything goes to the worst possible release category. Which is a combination of over-pressurization and liner melt-through at this point in time.

Like that. And you can see, we generated into the high level conservative estimate about 7 times 10 to the minus 8. As compared to the safety goal of 2 times 10 to the minus 6.

And you say --

MEMBER BANERJEE: That's at the worst

site?

MR. STUTZKE: That's at the worst. Of what site with the highest ELAP frequency. The site with the highest frequency of release.

MEMBER RICCARDELLA: Which is related to the seismic.

MR. STUTZKE: Which is related to -- well, a combination of seismic and the seismic response of the plant.

MEMBER BANERJEE: But the worst site must also take into account things like weather and the population distribution and all these other things. Right?

MR. STUTZKE: Yes. I don't disagree with you. I mean, ideally we would have a site specific set of MACCS runs.

MEMBER BANERJEE: Right.

MR. STUTZKE: For all the plants. But that's not feasible to this.

MEMBER BANERJEE: Right. But would you -- how would your estimate do in your judgement encompassing that sort of thing?

MR. STUTZKE: I mean, it's to my mind, it's an overlap of the meteorological patterns and the population, the demographic data.

MEMBER BANERJEE: Direction the wind blows and all that sort of stuff.

MR. STUTZKE: Like that.

MEMBER BANERJEE: Right.

MR. BARR: Right, exactly. And you almost have to look at the actual weather data that would correspond to the different sites to know.

So, Peach Bottom is not the most populous site, Mark I site within 10 miles. It's very high within 50 miles. But not within 10.

However, we could look at a higher population site in 10 miles and find that the wind typically blows away from population centers. So, just because it has a higher population doesn't necessarily mean a higher response.

MEMBER BANERJEE: Generally, your worst case is a Pascal-F weather? Or what sort of weather gives you your worst case?

MR. BARR: Generally, either the highest consequences would be when there is rain over a population center.

MEMBER BANERJEE: Oh, rain.

MR. BARR: Or when there is extremely slow winds.

MEMBER BANERJEE: Which would be F

probably. Right, the unknown weather conditions.

MR. BARR: Yes.

MEMBER SKILLMAN: Are the data for selecting the worst meteorological site and the data for selecting the worst ELAP site readily available to the public?

MR. STUTZKE: I don't believe -- I don't recall in the draft regulatory basis that we provide results on a plant by plant basis. I need to check.

MEMBER SKILLMAN: It would seem that for this argument to be convincing, a reasonable member of the public should be able to find that information. And include in his or her own mind that you've really identified what is that worst product.

The greatest ELAP frequency and the site that has the meteorological information that would suggest that is the most vulnerable site.

MR. STUTZKE: Yes. So I guess the -- to wrap this up, of course we'll go to Robert, is that, you know, again, you can see reductions or changes in risk as various -- as a function of the various CPRR strategies in there.

The changes are small as compared to the overall uncertainty in the calculation. We -- looking at the available uncertainty information that we have,

we are well below quantitative health objectives.

MR. BEALL: Okay. The last slide to wrap up our presentation. Currently the CPRR rulemaking activities have been discontinued.

The staff is planning to capture the excellent job that the folks in research have done to support the CPRR rulemaking as a NUREG. So, we'll hope to have that documented and out sometime next year.

And the Agency will continue to proceed with implementing the Order EA-13-109. That concludes our presentation.

MEMBER SCHULTZ: Are there questions by Members of the Committee before we move to the industry presentation?

(No response)

MEMBER SCHULTZ: Hearing none, thank you very much. Appreciate the presentation today. And we'll move right to the industry presentation.

If you would like to stand up, now would be the time to do so while we make the change.

CHAIRMAN STETKAR: Just Steve on your microphone. Just don't hit the microphone with your papers.

MR. KRAFT: My apologies.

CHAIRMAN STETKAR: And keep it turned off when you're not speaking. That's the other thing. For those of you who haven't been here, we've instituted a new policy that when you speak, turn it on. Otherwise -- it helps not only our transcript, but also people on the bridge line.

MEMBER SCHULTZ: We're then ready for the next presentation from members of the industry. And I'll call upon Steven Kraft to orchestrate the next presentation. Thank you, Steve.

MR. KRAFT: Well, thank you. Thank you, Mr. Chairman. I'll make another observation since you've changed the procedures for handling the microphones.

And I think my team, if you slide them a little closer to you, it might be better. I've also observed, you've increased the wattage of the lights overhead. I sit in this seat often enough I can tell the difference.

And I'm not so sure if it's that heat or that heat at the other end of the table. But we'll determine it going forward.

MEMBER BROWN: You and I have a stronger difficulty with that sort of temperature down there.

MR. KRAFT: Yes, I have to remember to

turn on the -- yes, okay. Thank you, Charlie. I appreciate that.

MEMBER BROWN: To the point. It was important, the levity.

MR. KRAFT: So, thank you again, for inviting us too such a --

MEMBER POWERS: I've noticed also fast and more cooling capability too.

MEMBER BROWN: That's also true.

MR. KRAFT: You know, if we tell jokes long enough, we can get through the time and just sort of call it a day, right?

MEMBER POWERS: I guess so.

MR. KRAFT: Again, thank you for the opportunity to meet with you. Let me introduce my colleagues. Rick Wachowiak from the Electric Power Research Institute. He's the Project Manager for the CPRR rulemaking analysis that EPRI did.

Jon Grubb, who you may not have met before, is the General Vice Chairman of the BWR Owners' Group. He's with us today specifically to talk about operator preparedness for beyond design basis events.

This is a question that's come up several times in our discussions. So we thought we'd ask Jon

to come along and talk about that.

And to his right is Phil Amway. Who is -- you are familiar with, Exelon Corporation.

So, I only have one slide here. And that is to indicate our reasons for why we think the Commission decision to end the CPRR rulemaking, deciding there's no additional regulatory actions necessary.

And that is first and foremost, and perhaps the main reason is it was the right decision for safety. In doing so, the Commission focuses both industry and NRC resources on what is truly important in safety.

And that ought to be something that should apply regardless of what topic we're talking about. Along with that is that the 29 affected plants are already taking actions to protect BWR Mark I and Mark II containments using the industry endorsed guidance and pursuant to the Order.

So, as was reported as stated by the Staff in a previous panel, no one's planning on building a Mark I or Mark II. No licenses are expected. This was addressed in the Commission both records. And I though talked about that quite extensively.

The critical regulatory principle is

upheld. That decision should be based on quantitative evaluations. And then quoting from the SRM for SECY 14-0087 on back fit rule and qualitative factors.

Qualitative factors should only inform decision making in limited cases when quantitative analyses are not possible or practical. I think this applied in both the decision on this rulemaking as well as the decision on the mitigating strategy we're making to not include CMGs in requirements.

In both cases, the settings were very much the same. Industry is already doing these things, et cetera.

And that last item in the staff -- consistent with the staff's recommendation, CPRR rulemaking, quantitative recommendation analysis fully supported, taking no action requiring external containment on filters where the staff recommended. So that I thought was another reason why this made some sense.

Before I turn to Rick to carry the technical discussion, let's just go back for a moment to the questions you were asking the staff about what happens when the Order is issued. And what you can do.

So, I think as I followed the

conversation, I think you finally got to the point of agreeing or that upon issuing the Order, it becomes part of the license. And this has to be done in accordance with whatever guidance is approved, et cetera.

But the question that came up that I thought was asked one other time as well, was go out seven years. And for some reason that I have a hard time understanding why it would be true, but let's accept it as such, a licensee decides they don't like the system anymore. Or the cut the pipe flange it off and come up with something else to do.

And how does that get noticed by the Commission? It is true the Order itself has no inspection requirements in it. That would be something a rule would do.

Because the Order is part of the license, it is inspectible by definition. Then what happens is that as noted in Chairman Burns' vote record, the only guidance approved available is the NEI 13-02 requires everything that we, you know, have in that, in that Order in a guidance to apply to the Order.

And if a licensee chooses or a licensee chooses option two under the Order, which is the -- somehow a drywell vent that would somehow work. I

don't know how without water addition, but it does. They have come to back to the staff and explain how the Order is met.

And that is the key right there. You don't get out of that. You have to come back to the staff. And I will tell you that we've had workshops and meetings with the industry where we have talked about this.

That if you are going to get so clever as to say I can design that drywell vent. I can find that valve disc material that will work.

Well, first of all, there's no guidance that we are providing that allow that to happen. That is made very clear in our guidance. You are forced back to the Commission staff. And they will ask you the same questions.

So, there's no way really out of it. And I'm pleased to say as we reported to the Subcommittee back in mid-August, that the BWORG did a survey of its membership. All 29 affected units are going to be water additioned. They also are going to do water management and avoiding the severe action drywell vent.

And as I -- we also reported, we are conducting what we are calling a Consistency Assist

Program. We've been through several meetings. Phil was one of the leaders of that effort to assure that the 29 licensees are complying with the guidance as it is written.

Granted, it was not done the same way at every site. But that is -- we've never done that before. I think that is an important step we are taking here to assure that we actually close off any possibility of, you know, not quite meeting it.

VICE CHAIR BLEY: Steve, can you tell us a little more about that? How that works?

MR. KRAFT: Yes. Sure, Dennis. We of course divided the country into regions and fleets with BWRs. Each fleet, Phil representing Exelon was the first one, were given a set of questions as to how are you from a design philosophy point of view going to meet the order? It was all done in spreadsheets.

And then we had a group of people of people from the BWORG Fukushima Committee. I was the loan NEI representative of course. And then we went through how did you do that? How are you meeting that?

And it was interesting to, you know, someone says hey, we're doing it this way. And another says oh, that's a great idea. So, we're

actually seeing some knowledge transfer going on.

And we're having another meeting, is it the end of the month in Minneapolis, right? To finish that out. Phil, do you want to talk about that?

MR. AMWAY: Yes. There's one at the end of this month. And we're going this in two phases. Every site now, with the exception of maybe a few that are later on, have gone through and at least done a preliminary look at their plant with the guidance.

And said, this is how we would do SAWA/SAWM. So, that's kind of a high level, even preconceptual design phase where we scope out what it would take to implement SAWA/SAWM.

We'll do another phase later on in November before we submit the Phase II OIP. Where we'll go back and say okay, on such and such a date, you presented your scoping evaluation as this.

How does that translate to the OIP that will be submitted at the end of December? So can look and make sure that was consistently done throughout the initial scoping evaluation to the OIP, which actually gets submitted.

MR. KRAFT: And just one additional step. You have to -- we actually have a workshop next week, a combined NEI and Owners' Group workshop where we are

going to walk through the template for the OIP.

So, there will be specific training as to how you fill out this part. And what analysis is required. What designs are required.

So, we're doing a lot to ensure that this is -- we know this is complicated. And we're doing a lot to ensure that it's done correctly.

VICE CHAIR BLEY: Does INPO have a role in this process?

MR. KRAFT: Not yet. But they are -- you probably know more about it then I do. And that IER that they --

MR. AMWAY: Yes. I'm not sure that the IER goes to that extent. But, what we did was, as part of this process, we did the two pilot plants.

We had a Mark I pilot that went through and took their initial scoping. Filled out the OIP template with what their plan is for implementing Phase II.

We did the same thing with a Mark II. And then now that can go out as to the other sites as an example of okay, we have the template. Here's an example of one filled out for a Mark I. Here's an example of one filled out for a Mark II.

That's how were did with the Phase I. It

worked very well in terms of making sure we had a level of consistency. And now even with these additional design consistency reviews that we're doing for Phase II, will even bring that more into focus and make sure that we're consistent in Phase II.

MR. KRAFT: Right. So specific to INPO though. I think where INPO might get involved in operator training and things like that after this will implement.

I know that they have their own set of -- they don't call them orders obviously, but IERs, that, you know, talk to requirements that they would look for. That of course go beyond NRC regulatory requirements into an area, you know, of excellence.

So, I think there's going to be some actions taken there. But I don't think that's been figured out quite yet for this.

VICE CHAIR BLEY: Now, is somebody going to talk about how this rolls into training and -- so I'll wait for that.

MR. KRAFT: Yes. Okay, Rick. You're up.

MR. WACHOWIAK: Okay. Good afternoon. Rick Wachowiak from EPRI.

And we performed an independent analysis of different strategies that could be used to reduce

the probability of containment failure. And to reduce the release of radioactive materials into the environment for an ELAP condition.

What we are trying to do here, is establish the basis for any type of changes that could be done to a plant in order to achieve the goals for the CPRR rulemaking. And the way that we did this was very similar to what Marty talked about.

We performed a focused Level III PRA for a representative plant. And with an ELAP condition initiated by various things. Losses of offsite power, loss of the grid, seismic events that sort of thing.

And in our ideas for doing this to begin with, we decided that it would be good to look at how each end state progressed through to the release.

Because what we found in our original report that we did back in 2012, that the results in terms of the release were dependent on -- highly dependent on the boundary conditions caused by the scenario that you are in. The timing, the failure mode, the condition of the components in the containment.

So, we took the route of going through a focused PRA so that we could assess all of the scenarios. And we could identify the dominant

scenarios. And we could look at how the accident progressed through each of those.

It's been the industry's contention all along that severe accident management guidelines played a great -- will play a great role in the reduction of releases. And in the management of the accident.

And that the operator actions that need to take place are really a shaping factor in all of this. So, our analysis included the -- included operator actions.

Now, before we get into how we quantified those or anything like that, we focused on the dependence between actions. Things that would happen early in the scenario and how that would affect the outcome later in the scenario.

So, we focused more on the dependence between actions and used the methodologies, SPAR-H methodology that's been used in other PRAs to calculate the numbers.

We did sensitivities and found that the individual values that we assigned to the operator actions were really insensitive for the result. But the dependencies between the actions were where the important pieces were.

If the operators failed to do something early, that affected their ability to be able to do something later. If they didn't have certain pieces of equipment, it affected their ability to respond to events that come later.

So we found -- that's the one part that -- one of the parts that we focused on was getting the dependence right.

MEMBER CORRADINI: So, just to ask --

MR. WACHOWIAK: Go ahead.

MEMBER CORRADINI: John's question of you guys in a similar fashion, so you not only looked at equipment failures, but if they didn't get an operation done in a time window that was considered a failure. But they could recover from that because they had more time to maybe implement it later in time? Does that make sense?

MR. WACHOWIAK: Yes. If we were addressing a different phenomena. So, if they were unable to get a portable pump installed in time to prevent core damage, we gave them credit for being able to get that water on the floor. Some credit for being able to get that water on the floor to cool the debris later on.

And we essentially took the same approach

that Marty did. That if the RCIC failure was early that we didn't give them any credit.

However, we went through and looked and took some of these plant surveys that Steve talked about. But they were done for identifying plant differences.

And saw that there was some margin there. Most of the plants could actually install their portable equipment faster then the required time.

And so we think if we were to go and do a further study on this, you'd see that there's some more margin. You could get some credit for getting things installed a little sooner if the installed equipment wasn't there in some scenarios.

CHAIRMAN STETKAR: You said you took surveys of plants. And you said most could install the equipment faster then their omitted time.

MR. WACHOWIAK: Said that they could.

CHAIRMAN STETKAR: Said that under the worst earthquake that anybody's ever seen?

MR. WACHOWIAK: No. We didn't go into that.

CHAIRMAN STETKAR: Because that's the presumption on these analysis.

MR. WACHOWIAK: Yes, we didn't go into

that sort of detail. However, you have to remember that this is supposed to be a mean analysis. And in some cases they probably could. And in other cases they probably couldn't.

So, for example, if we got into a -- it's almost irrelevant with this because we didn't use it in the analysis. We used it as a sensitivity to see how close we were.

Because everybody with their licensee committed times right on the bubble of where the accident would go. It's now there is some margin to that. If we use the committed times, then missing it by a few minutes doesn't help the ability analysis.

CHAIRMAN STETKAR: Can those committed times theoretically account for beyond design basis seismic events?

MR. WACHOWIAK: I believe it does. It's in the FLEX arena.

CHAIRMAN STETKAR: Right.

MR. WACHOWIAK: So --

CHAIRMAN STETKAR: Well, but we're talking about the same people and equipment.

MR. WACHOWIAK: Same people, same equipment. I --

MR. KRAFT: The way I understand, INPO did

some checking how industry was implementing FLEX. And the results of that were that for example, under the guidance 12-06, or for FLEX, you have to be able to deploy within six hours.

And so go give you the most margin, you then say you look at your -- you analyze your deployment time. You say well, okay, it's two hours. So you back up and say four hours after certain, we'll start to deploy. When in fact we know they'll start to deploy as soon as they can.

So, there's that margin that's inherently built into these surveys. Although as Rick points out, it's not the same at every plant. Not everyone has the same particular margin.

MR. WACHOWIAK: Okay. And as I was going into this, the accident management really involves several things. Cooling the debris, managing the decay heat, making sure that the consignment isn't challenged.

And then if you are going to have a release, to do the actions that you can to shape the release. So that it's as small as you can make it.

So, our objectives in the evaluation. First, we wanted to do a -- to look at a comprehensive set of the scenarios in a probabilistic framework.

Thus, getting to the focus Level III PRA.

As an offshoot of this, we're -- also, we're looking into what role FLEX plays in ELAP mitigation in the risk arena. And we started that off with this analysis.

And now there are other groups that are analyzing using the benefits of FLEX possibly in other risk informed initiatives. Most of it's voluntary internal plant stuff right now. That's the stage that we're at with this.

We also have a group at EPRI that's looking into how do you really quantify the operator actions. Or they're not really operator actions at that point. It's more institutional actions that are going on at the plant.

And we have another project that's looking at how you would go about calculating those.

MEMBER SCHULTZ: Rick, it sounds interesting. Could you have an example of some of these strategies that are being discussed?

MR. WACHOWIAK: Other strategies that are being --

MEMBER SCHULTZ: Well, what you've described here is that there's other work going on, on other projects. And we're looking for other

opportunities to use the FLEX equipment. Can you give an example that would help us understand what's being discussed?

MR. WACHOWIAK: Well, some of it is dealing with how do you -- how would you in a defensible way, put FLEX into your plant PRA?

So let's say a -- some sort of a significance determination comes up. How would you factor that in? What types of information would you need? What is the role of the equipment? Role of the operators in being able to defend that SDP?

That would be one case. Another is that maybe there's some things associated with a risk informed application. Is it right to put the FLEX equipment in there?

Or is it better to not have it in that particular application because of the other things that creep in around it. Like maintenance rule and other things like that.

So, really, we're looking at scoping. How does the industry want to use and how should they use the FLEX equipment in their probabilistic framework?

MR. KRAFT: There was a -- this is a nascent, where the work is being run out of the risk department for EPRI. And NEI has a part in it.

But I believe you actually saw part of it at Palo Verde when we were behind Unit II. One of the FLEX pumps was positioned and strapped down. It wasn't hooked up.

And they were using that during I believe an outage, if I remember the story correctly. And it put them in a lower risk category during that outage at the time.

It's a way of getting more use out of the same equipment. That's the most obvious part of it that would be helpful. There are others that are being explored.

But again, you have to be careful. For example, one plant's spent fuel pool implementation, which isn't part of the FLEX order, but the same concept, has decided to make that new wide range instrumentation their normal instrumentation.

Well, the moment we heard that, we told them, you better start looking at cyber security, designation of critical digital assets, maintenance role. You have to look at that stuff and either analyze yourself into it or out of it, however it is.

But once you go beyond the use as intended, credited use under the intention of the order, which is the ELAP conditions, you then find

yourself in this other space you have to pay attention to. So it becomes a corporate decision at the end.

MR. WACHOWIAK: So, another thing that we wanted to do in the analysis was understand the dominant severe accident scenarios. What are the things that are getting us to the point of having some sort of a release? And focus our strategies on the scenarios that are really driving the risk.

That was one of the things that was in the original SRM that started this whole thing off. To focus on the dominant scenarios. And we took a look at that.

We also found that some of the scenarios that we evaluated in the previous paper from 2012, didn't really turn out to be the dominant scenarios. That other things were dominating the risk. And it was an interesting insight from this.

We want to look at ways to look at -- I'm sorry. We want to make sure that the way that we present our filtering strategies that that is clear, understandable, and people can, when they look at the analysis, they can tell how the thing's proceeded from the beginning to the end.

We are publishing this in two steps. The first step is our report that's out right now. It

describes what the purpose of the report -- or purpose of the analysis is. What the results are.

But the details in how we actually did all the different analysis and what the nitty gritty on all the event trees and all that, they're in a subsequent report that's going to be published later this year.

And John's probably the only one who is going to be interested in looking at that. It's going to be several thousand pages of event trees and things like that.

CHAIRMAN STETKAR: Bring it on.

(Laughter)

MEMBER POWERS: Rick? Quit trying to suck up to the Chairman.

(Laughter)

VICE CHAIR BLEY: When you started digging into the dominant scenarios, did you have fully -- full scope PRAs with fire -- good fire PRA and seismic and other externals?

MR. WACHOWIAK: Yes. We included seismic explicitly in this. We did not do the details of a fire PRA in this.

Now, there was some reasons for that. One, with a hypothetical plant, it's really impossible

to get all of the different dependencies that might show up with spurious actions. Things like that.

So it wasn't really feasible to do that piece. And in looking at the contributors to ELAP, we're not sure that fire is going to be a -- is going to be a large contributor to ELAP itself.

Now, there might be some things with diesel generators and stuff like that. But, once again, we -- we're just not sure that that gets us to the ELAP.

The loss of offsite power, yes. But I'm not sure that it's going to be dominant for ELAP.

The other interesting thing that we found with the seismic portion though, is that everything, if we alter the seismic contribution to the ELAP, it kind of just shifts all our numbers all together.

It doesn't change any of the deltas that we look at. It's just if you have a greater seismic cap -- or seismic hazard, then everything shifts up. And the deltas between the strategies shift up.

If it's lower, everything shifts out. Because the seismic tends to cause the things that just can't be dealt with by any of the strategies anyway. Too much of the infrastructure gets damaged. And most of the things go down the damage branch.

It was an interesting study.

VICE CHAIR BLEY: All right. Well, one wonders if that's because of the way your -- this plant, imagined plant is set up. Or if it's, you know, is it part of the analysis process or is it real?

MR. WACHOWIAK: That's a good question.

VICE CHAIR BLEY: And if somebody were looking at their own full scope plant specific PRAs, we might get a better feel for that.

MR. WACHOWIAK: Yes, you'd find some different things. Especially from the fragility. Because we picked a particular fragility for the DC system based on one of the configuration that's out there that's not really amenable to staying together in a seismic event.

So, yes, that's part of a bounding piece of this. But, once again, you'd have to go through all the differences.

Marty took a shot at that. And I think he came to about the same conclusion. That the delta results all follow along in the seismic area.

We wanted to inform the implementation of 13-109 to the extent possible. And we used some of the results from this to identify how water addition

is beneficial to the plant. Should be included in 13-109.

And how it affects the temperature and other boundary conditions inside the containment. Making the equipment being installed for 13-109 in the reasonable range rather then the super range that was talked about earlier here.

Providing insights to the Owners' Group on the EPG/SAGs, we'll hear a little bit more about that later. But there's a couple of things that have been approved by the Committee that have come out of this work on how to implement SAWA and SAWM in the EPG/SAGs that follow along with what we did.

We set this analysis up so that a cost benefit could be done later as a follow on. That never actually got to a point where it was needed. So the industry did not do any cost benefit analysis.

So, here's our chart that looks somewhat similar to what Marty had presented. I have only mean values on here.

We didn't do a comprehensive uncertainty analysis. But we did do sensitivity studies or sensitivity analyses to see which types of things could affect the outcome of the means.

Our pink bars are basically a vent is

available, but there's no SAWA. The green bars are things where SAWA is there, but it's injected via the RPV. So it goes into the RPV, through the hole where the core debris came out and into containment.

Blue is directly injecting into the consignment. And the hatched areas are the ones where we looked at what we might be able to get further with some sort of hypothetical engineered filter.

Our results are a little less scattered then what Marty's were. It may be because ours is on a log scale and his was on a linear scale. But, it in general were the same sort of results.

And we superimposed a -- what looks like it was a preliminary version of his 5th and 95th on there. I noticed that from his higher scenarios, the upper black X was about 70 minus 9. And so we didn't try to match one to one.

I think his lower 95th was somewhere in the 1 to 2 times 10 to the minus 10. So, it must have been 3 times 10 to the minus 10 a few months ago when we published our report.

So, in here, we can see that we're well away from the QHO on this particular risk metric. Our results are right in the middle of where the NRC got their results.

They used a similar type of analysis. And we expected this to be the same. We've done sensitivities where we show how much these move around based on different operator actions. Or different frequencies for ELAP. And different seismic fragilities. Different things like that.

And things move around a little bit. But they don't really change all that much. I mean, we're still talking about 2 times 10 to the minus 9 here. So, it's not changing very much in an absolute scale.

MEMBER SCHULTZ: Rick, could you describe why your results in the cases for engineered filters don't show a differential between the different approaches that are used with regard to the engineering filter design?

MR. WACHOWIAK: Because this particular risk metric is driven by the scenarios where the filter isn't effective. So, if I were to split one of these bars, let's say the green -- one of the green ones was there.

How much of this risk is associated with an unfiltered release because it bypasses the filter. Versus how much of it is in -- risk is in the filtered release.

What you'd see is a very small sliver in

the filtered release part. And the risk itself is driven by the scenarios that have un -- that are unfiltered. Even though the filter is present.

MEMBER SCHULTZ: So again, it's a combination of scenarios similar to what the staff presented.

MR. WACHOWIAK: Yes.

MEMBER SCHULTZ: Thank you.

CHAIRMAN STETKAR: But despite that, the staff did ostensibly the same thing. And they were showing roughly a factor of 2ish.

MR. WACHOWIAK: Yes. There's a reason --

CHAIRMAN STETKAR: It's thought to be discernable.

MR. WACHOWIAK: There's a little bit of a reason for that I think in that the difference between the ability to do a MAAP case for a scenario versus a MELCOR case for a scenario. I think they had approximately 20, 30 some odd MELCOR cases that they bend into their different results.

We did an explicit MAAP calculation for every single one of our results. And so, some of the way that the venting was, you could get more credit for a filter or less credit for a filter depending on which scenario you pick.

And so I think some of those variabilities probably had a little bit more to do with venting them. The other thing is that MELCOR in these calculations does tend to in some of the scenarios that turn out to be a little more important, not the dominant ones.

But the ones that are a little bit more important get to a point where the filter works for a while. But then the vessel fails. And the liner melts later. And so they're getting a little bit more performance out of a filter then our MAAP cases did because of the timing of the containment failure.

So, a little bit of differences on the consequence analysis. But as you saw with the ranges on there, I, you know, the differences are within the uncertainty of doing any of these calculations.

But I think that's -- those are the chief reasons why you saw a little bit of movement on the NRC cases. And not as much movement on ours.

MEMBER POWERS: Excuse me, Rick. I presume these are again averages of all the plants? And do you have any comments on that?

MR. WACHOWIAK: Yes. We didn't do a fleet average like Marty did. We picked a representative plant.

MEMBER POWERS: Okay.

MR. WACHOWIAK: So this is for a representative plant. Now we looked at some features that other plants had that we thought might affect what the analysis would do.

And we compared the representative plant to the -- for the -- to information that was received from other plants. You know, how do you do these things?

MEMBER POWERS: Um-hum.

MR. WACHOWIAK: What are the -- you know, what are your seismic characteristics? Things like that. And then we did sensitivity studies in our report to identify whether or not those idiosyncrasies from the different plants would make a difference to the conclusions that we're reaching.

And we decided that it's all -- it wouldn't make any difference in the conclusion that you draw. That there is very little difference between anything except adding water.

Adding water is really the only thing that we see where it makes a marked change to the outcome of the risk.

MEMBER POWERS: Thank you.

MR. WACHOWIAK: And so yes, we did it for

sensitivity and not through an uncertainty sort of analysis.

Okay. What did we see in this study? The role of the operator is essential for this. As you can see on the fourth bullet down there, explored adding something that was maybe totally passive. That didn't involve the operators.

What we found is that water addition was always going to require operators. There really isn't a passive way to retrofit that onto an existing plant right now.

And when we tried to put in a passive vent, the designs that we came up with for a totally passive vent, had the unfortunate response that it increased the core damage frequency. And so even though it did some things to reduce the releases, we had an increase in core damage frequency.

The reason why it increased the core damage frequency is it took away the -- one of the FLEX options for extending RCIC operation by venting the containment.

So, yes, you can do it. It change -- I think we'd rather keep the core from melting rather then having the incremental capability on the release.

And then that was even in one of these

other bars here though. I don't remember which exactly one it is, passive filter down here.

When we get to the consequence analysis, the core damage frequency increase is offset by a little bit more filtration. And the risk comes out to be the same anyway.

So, still, we thought it was better if we preserved that.

MEMBER SKILLMAN: Rick, perhaps it's simply assumed in bullet one. But it seems to me that an additional insight would be if the essential -- if the role of the operators is as essential as you indicate, that training has a yet more important role then it might have had before.

MR. WACHOWIAK: I think John's going to address the training on the severe accident guidelines.

MEMBER SKILLMAN: Okay. Thank you.

MR. WACHOWIAK: Oh, let's see. The importance of water addition was identified here. I think we've said that at every meeting.

It is something that can show a difference between, in the risk from what we have without the water addition. But remember, water addition has always been part of the severe accident strategies at

the BWR.

It's always been there. What we did hear though, is say, let's look at the scenarios you might be in when you need the water addition. And let's make sure that the water addition is available in the dominant scenarios.

In the scenarios that you might get a chance to use it. So, it wasn't really identifying, oh, yes, you need water. We always knew you needed water.

This helps us identify what are the conditions going to be when you need the water. And if it will inform the plants on how they're going to implement the water.

As I said, we did try to confirm that our analysis was robust by doing various sensitivity studies not only on phenomena that might happen in the -- during the course of the scenario. But also, at some different configurations that some plants might have.

And tried to convince ourselves -- we did convince ourselves that there wasn't really something lurking around the corner that was going to change the results by -- an awful lot from what we have here.

MEMBER SCHULTZ: Rick, I understand your

comments about we always knew that water was important. And that the operators in any response would be trained to add water, add water, add water. That happened after TMI for sure.

But my question is, it did seem that when we first started looking at severe accident capable venting through the drywell that it was a revelation. That in fact the drywell vents were not going to be able to perform their function given the temperatures that were being calculated for the severe accident.

MR. WACHOWIAK: Yes. That's what I mean by identifying what are the scenarios? What are the actual conditions going to be.

Like I said, I mean, who we had with that water --

MEMBER SCHULTZ: Okay. Okay. I was just wondering if it would be specifically related to what we found with the drywell vent. Because that was significant.

MR. KRAFT: Yes. There was a -- more of a moment in our consideration of all this where, as I said before, the ability to add water is the essence of all our safety systems.

So that's nothing new. And under this Order, it's to add water -- well, it's to be able to

vent containment with the power out, let's just say that.

Reliably, you know, the word reliable drives a lot of the Order. But, when we finally finished up the wetwell vent and the industry was launched on doing those plans, we began turning our attention to the drywell vent.

And by that time Rick had enough analysis done that we were starting to see the temperature profiles in containment, it occurred to us that the original thought when we started writing, you know, industry started writing the Order, was we knew water addition was going to come along.

The question was, where in the sequence of the development of the requirements was it going to come along? And it occurred to us that water addition as part of the Order actually made much more sense then waiting.

And then of course the water addition then, you know, also has the filtering effect that research was showing. So, we came to NRC senior levels saying, you know, we need to modify our guidance.

And there was a brush up on that. I wrote a letter that got, you know, a good response.

So, the point being, is that you're right. There came a time where we said, you know, we learned from this. Let's do this the right way.

And then everything is beginning to fall out the way they have.

MR. WACHOWIAK: And one of the interesting things at least to me, about this was, when we started looking at ways to get the information from our analysis off of our super computer, is we used our super computer to analyze all of the scenarios individually with the MAAP and MACCS run.

It generates a lot of data. And we have to find ways to get it off the computer and be able to look at it.

And this temperature thing with SAWA didn't come out really until we'd developed one of those ways. We took a slice of things and oh heck, when water works, the temperatures are always down.

When water doesn't work, the temperatures are always up. So, if you add SAWA to the vent, the temperatures for the design come out very nice.

And so, I've covered all these things. But I just want to say, the water addition provides the best -- overall best safety benefit. But once again, everything is in the very, very low range of risk.

And so, it does provide benefit. It's the right thing to do. And what we're -- we were already doing it. What we want to make sure we understand is, is it going to be there when we need it.

And this helps inform us what types of design considerations, access considerations, do we need to do to make sure that we implement these things that were in the SAMGs.

Our other conclusion is that we couldn't come up with any way to do this without operators. So, just like the questions that keep coming up, where does this fall? And a lot of it falls into the SAMG development.

And other alternatives that we looked at, we found things that in some scenarios would reduce the releases. But when we put them in the overall context of the whole probabilistic framework, when we looked at all the scenarios, it just didn't affect enough of the dominant scenarios to make much difference.

That's it for me. I'll let you figure out how to get the next slide.

MR. GRUBB: All right. Good afternoon. I'm John Grubb from Xcel Energy.

In my day job, I'm the General Manager of

Fleet Operations for our Fukushima Response at both our Monticello and Prairie Island plants. So that's implementation of all of the Fukushima related Orders for our two sites.

I'm also, as Steve mentioned, I'm the Vice Chair of the BWR Owners' Group general committee. And I'm going to talk about what we've done to try to prepare our operating crews for beyond design basis events.

First off, information on the BWR Owners' Group. It's a forum for our member utilities to improve plant safety primarily.

We also look at improving reliability of the plants, minimizing and sharing costs, and also very important, to facilitate regulatory interaction with both INPO, the NRC, NEI, EPRI, all the key stakeholders.

All U.S. Boiling Water Reactors, all of those utilities are members. This BWR Owners' Group is open to all international BWRs. Currently we have 12 international BWRs that are participating in the Owners' Group.

MEMBER SCHULTZ: Is that by utility? Or --

MR. GRUBB: By utility.

MEMBER SCHULTZ: Okay. Thank you.

MR. GRUBB: And I have the list if you want to see it later.

Within the BWR Owners' Group, we did form -- our initial committee was an ad hoc committee formed in late 2011 that became a general committee that all members participate in.

And ad hoc is just a quicker way to get moving on the process. So we did that initially.

That was first formed in late 2011. That Fukushima Response Committee then worked with the existing Emergency Procedures Committee, which I'll talk about on the next slide, and with EPRI to develop the criteria for the FLEX support guidelines.

It's important to note that the procedures, these FSGs that we have developed at each site, do work in conjunction with the EOPs and SAMGs that were already in place.

So this was not something sitting off on a shelf that the operator's got to think of at the time of this unusual event. They're integrated into the existing EOPs and SAMGs.

Also, that each plant used this generic set of criteria that we developed as an Owners' Group. And developed plant specific FLEX support procedures

for beyond design basis events.

We will use -- we are using the exact same process for the 13-109 Order. The vent Order requirements for both Phase I and Phase II. So, the industry -- you know, the Fukushima Committee and the Emergency Procedures Committee are putting together the criteria that the individual sites will then use to meet the requirements of the Order.

All right. Emergency Procedures Committee. We've had this in place for a number of years. This is ac -- that Committee has experts from each one of the U.S. utilities as well as several international BWRs.

The focus of this Committee is improving plant operations and safety. And then we are taking into consideration the events at Fukushima.

And out of that we have been able to already make changes to the emergency procedures, the severe accident management guidelines. And we are implementing those into the FLEX support guidelines as well.

So, that Committee is very active. I think we have -- at this point, we have five subcommittees of the Emergency Procedures Committee, looking at the different aspects of the Fukushima

lessons learned.

It's important to talk about the BWR Owners' Group does work quite a bit internationally to make sure not only are we sharing with our international partners the lessons we've learned through our implementation of the FLEX and the Orders here.

But, also they're sharing with us what they're leaning. Because a lot of the internationals are taking a slightly different approach then we've taken in the United States to the Fukushima response.

So, we have tech support guideline skill set workshops where we go to -- we do them both domestically and internationally. Where we get together with the BWR partners and talk about the lessons learned.

We also do the severe accident workshops. And both of these have case studies where we will walk through the events and the sequence of damage accidents.

And talk about why we made choices within the United States on the FLEX criteria that we put in place. And listen to the internationals tell us why they might have gone a different route.

This Committee also advised the Owners' Group and individual member utilities on issues related to the emergency procedures. It's not at all unusual for an individual plant who is in the process of making a change to their emergency procedures, to contact a chair of this committee and say hey, let us run something by you. Could you talk to the committee about this? Does this make sense, the road we're heading down?

This committee also, it's really -- keeps the history of the emergency procedures. So, it maintains the guidelines. All the appendices. All of the issue files, conference reports.

So we can see from when we first put this committee together, the series of decisions that were made to the existing emergency procedures that we have in place at this point.

This is kind of a pictorial pre-Fukushima. On the left there is the procedure hierarchy we had at the BWRs, starting with design basis external events. Station lack of coping capabilities. And the super accident management guidelines working in conjunction with the emergency plans.

When you think about the procedures that we put in place for FLEX and will be similar for the

severe accident -- or the vent Order, it's really just an increase in defense-in-depth procedurally and training wise. Because we're preparing the operators for something that wasn't really part of their training prior to this.

We're giving them a set of tools that they can use to diagnose and manage the plant for this different set of events that we're looking at for both FLEX and for the vent Order.

All right. Again, I mentioned that each plant used the generic criteria to develop a set of specific FLEX procedures for response to beyond design basis events. We're going through the same process for the vent Order right now.

The procedure guidelines and the criteria are being established by the Fukushima Response Committee working with our Emergency Procedures Committee.

At each one of the plants, and once they've developed their -- their onsite Fukushima team develops their specific criteria strategies and procedures for responding to the beyond design basis events that gets put right into the operator training program.

So they've got a -- there's a validation

process they go through. All the crews have to go through and perform these procedures in their training.

And all of this was required for FLEX prior to the plant declaring that they had met the requirements of the FLEX Order.

The FLEX and beyond design basis screening has been added to the operator training program. So it will be revisited at a frequency and depth as far as how much they cover it based on their existing training program.

It becomes a little bit of a balancing act because you don't want to take too much training time away from the normal training you do to run a complex nuclear power plant. But you also don't want to ignore it.

So the individual sites are making that determination based -- depending on where they are on their training program.

MEMBER CORRADINI: What is the purpose of that? You said, what is the frequency?

MR. GRUBB: The frequencies are defined by the individual stations. So the Owners' Group --

MEMBER CORRADINI: So it's a wide range? It could range depending on the plant staff?

MR. GRUBB: Correct. Another thing I wanted to make sure and mention on this slide, is the training wasn't just for operations. So, the FLEX and beyond design basis, there was extensive training and procedural changes done for the rest of the emergency response organization.

I think one of the staff slides talked about some of the other things that were done as part of the beyond design basis events. So, there's training for engineering, radiation protection, chemistry, even security depending on the plant and if you take credit for the security officers in your response.

This is a -- that was really the end of it. You know, this is just a sample of the approach that was taken at one of our plants on the amount of training that was provided to operations.

So, I didn't intend to go through this. I'd be happy to answer any questions.

MR. KRAFT: So that completes our prepared presentation to this.

CHAIRMAN STETKAR: Let me ask, John, one thing that I've asked a couple of times in the Subcommittee, and since you're involved with integrating the EOPs and SAMGs and FLEX procedures.

If I read the NEI guidance, NEI 13-02 that's specifically focused on compliance with Order EA-13-109, I'm left with the impression that I don't need to worry about getting water into what I'll call the reactor vessel or what you might call the plant from an external water supply for at least eight hours.

Which means that I have up to eight hours to try to get the pumps aligned. And power hooked up to valves that might need to be opened.

How are the procedures in the plants actually implementing that? Because there are many cases were if I could get the water in earlier, I wouldn't need it for a severe accident response.

So for ex -- my point is that if I decide to put all of my equipment in a robust shelter that's ten miles away from the plant because I've done an analysis that says within eight hours I can get it there.

And I don't have to worry about flooding. I don't have to worry about, you know, very, very site specific issues. Am I then precluding the fact that I can use it for other things, like preventing core damage?

MR. GRUBB: Well, what's interesting is,

at that the vent Order and the FLEX Order, they're not contrary to each other. But, for the vent Order, we've assumed FLEX doesn't work.

So, we got core damage and now we're dealing with core damage. The plants, we will always implement and put our FLEX equipment, our ability to put water back into either the vessel or containment in place as quick as reasonably can.

That will always be done. You can jump in here Phil if I'm --

CHAIRMAN STETKAR: But the NEI guidance specifically says I can have up to eight hours to do that.

MR. GRUBB: Yes.

CHAIRMAN STETKAR: So if I'm implementing -- if I'm following the NEI guidance, all I have to do is be able to demonstrate that indeed I can get a truck to drive the stuff down there and get the power and the water connected within eight hours.

And I can check off the box that I comply with the NEI guidance. That doesn't say -- that doesn't say well, of course I know if I get it hooked up faster that's a good thing.

It says that all I need to do is demonstrate that I can do it within eight hours. It

might be seven and a half hours.

So how now is the Owners' Group and the plants thinking about that from a realistic point of view in terms of maintaining the broadest number of options available to the operators? Not only to mitigate core damage, which we hope we never get to, but to prevent that core damage?

MR. GRUBB: Right.

CHAIRMAN STETKAR: If for example, RCIC fails at T0?

MR. GRUBB: Okay. And I --

CHAIRMAN STETKAR: Which is your -- which is by definition for BWRs with Mark I and Mark II, the FLEX Phase I equipment. Which is assumed not to fail.

MR. GRUBB: Yes.

CHAIRMAN STETKAR: So that's why -- I still haven't gotten a nice coherent story from people. So I thought I'd ask you since you're involved in getting people to actually do the things.

MR. AMWAY: And I'll start off, and feel free if you need to add or modify. But the eight hours, the way we - the way that's viewed from a 1302 perspective is that's what our analysis says how much time we actually have to prevent containment failure.

The actual implementation through the

procedures is, you know, we're using the same type of connection points and portable FLEX equipment to implement SAWA/SAWM as we did for FLEX. So I mean, we're all designing our FLEX strategies to get water into the vessel as soon as possible.

And our strategy procedures will start in the EOPs. Let's take your example. RCIC fails at T0.

CHAIR STETKAR: Right.

MR. AMWAY: Those EOPs are going to drive us to start lining up alternate water injection systems immediately. So the way this is really going to work, you know, if RCIC fails at time zero, the reactor water level's going down.

CHAIR STETKAR: Yes.

MR. AMWAY: And it's going to drive us through the EOP lags. We're going to initiate actions to start lining up the equipment, and one of two things are going to happen. If we're really good and we have a short deployment time, and we can, you know, let's say in theory we could hook up that FLEX equipment and start pumping in water before we get core damage. That's where we're at.

CHAIR STETKAR: I understand that if, if, if. What I'm asking about is if plants, say, and the staff does their reviews, compliance following EA, any

I13-02 is adequate to meet this order. And a plant decides that, "Yeah, I'm vulnerable to flooding or I'm vulnerable to some other damage, high wind damage or whatever."

And to protect the equipment that I'm going to take credit for in phase two of FLEX, or for severe accident conditions, I make the active decision that I'm going to park that equipment 15 miles away from the containment because I can demonstrate that I can get it there and hooked up within eight hours.

It might take me six hours, but I can do it within eight hours. I can't do it in an hour and a quarter. I just physically can't do it in an hour and a quarter. That decision would comply with all of the guidance, and yet they couldn't do it in your scenario with if, if, if, right?

MR. AMWAY: And I agree.

CHAIR STETKAR: So I'm asking on a plant specific basis, are people thinking about that?

MR. AMWAY: And the answer is yes.

CHAIR STETKAR: Okay.

MR. AMWAY: I mean, we are definitely looking at it. And like when we do the workshops and we're doing these design consistency reviews, if there's options that we can do that we can reasonably

shorten that deployment time and use of that SAWA connection point, we'll do that and we'll consider it. You know, and it's -

MR. GRUBB: The way we're viewing the eight hours is I have to have a strategy that I can deploy at my plant for any set of conditions, and this is beyond an assigned basis set of conditions, and assure, have absolute confidence I can have water going into the vessel inside that eight hours. It's - you'd almost like it going over and dropped in. If I can't do that, I can't use this strategy.

CHAIR STETKAR: You can't use it. You're right, but that's for containment protection. You're giving up the core. See, that's part of the way that the orders and the NEI guidance have been partitioned between FLEX, FLEX, FLEX, if I use the term FLEX, is to prevent core damage.

But there are built-in assumptions there like RCIC is my phase one FLEX equipment, and by definition it does not fail. So therefore, I don't need phase two FLEX equipment to prevent core damage because RCIC works.

Now the other flip side is now I've got NEI guidance for this other order that presumes I give up on the core. And it says well, to - the guidance

says all I've got to do is get the stuff there within eight hours because I've done the most limiting analysis for the most limiting plant. It says as long as I get the stuff hooked up, water - depressurized and water addition within eight hours or within some margin, I'm okay.

VICE CHAIR BLEY: Let me John's thing around a little bit. We understand that to get everybody together and move ahead, people had to pick starting points, and this was a starting point.

And kind of what we're asking now is we've gotten everybody together. We're going to meet that starting point, but are the plants thinking about real flexibility beyond just responding to ELAP or whatever it is?

MR. GRUBB: Yeah.

VICE CHAIR BLEY: That's what we're after.

MR. GRUBB: I do understand your question better than you all think. I'll take this back to our focus unit committee and make sure that they talk about that, and that it's covered in our workshops. But I can tell you as a plant operator, we're going to deploy the equipment. Anything to protect the core, they're going to deploy as quickly as possible.

And because of the way the order had to

assume some, you know, FLEX fail, they feel almost contrary to one another. But we will be able to implement the actions for both orders simultaneously. So we'll be taking all of the actions for FLEX as soon as we recognize and declare the event.

CHAIR STETKAR: And I think, you know, you said, "As a plant operator." I think that's a little bit from the perspective that we're coming through. Now that everything is starting to come together, people have developed strategies for FLEX. People have developed strategy for severe accident mitigation.

People have developed strategies for hardening and protecting the equipment that will be used. People are now developing guidance and procedures, and whether you want to call them guidelines or procedures, and training. All of it eventually comes back to those operators.

MR. GRUBB: Right.

CHAIR STETKAR: And I'd hate to be the operator sitting in the plant that says, "Yeah, I'd really like to use all of this stuff, but somebody made the smart decision that they wanted to park it 15 miles away because they were allowed to do that, and I can't get to it."

MR. AMWAY: And the thing I want to be careful of is for the vast majority of plants that have implemented FLEX with the hardened storage requirements, the location of where that equipment is being stored is already set. And the requirements of 13-02 is we protect it to the same level as we did for FLEX.

What we can do, and I think, and that's what I'm, you know, driving within my sights within Exelon, is where we can structure those procedures such that when the decision is made to deploy the equipment, that they're going to do it the same way whether it's an ELAP FLEX no core damage case, or an ELAP FLEX fails core damage case.

It's the same series of actions that they're doing so they don't get part way down one strategy and realize, "This doesn't work. I am now, you know, I've lost RCIC. I'm now on the SAWA case and I've got to jump over to this other procedure and get that out, and undo actions I did to get to where I'm at to implement SAWA."

And that's where I see the biggest benefit to shortening that deployment time, is to make sure that the procedures are structured such that, you know, it's a continuous set of actions from the time

they enter the EOPs, until they realize RCIC fails, to the time they start hooking up the FLEX equipment that's also serving the SAWA purpose.

CHAIR STETKAR: Right.

MR. AMWAY: So that there's no delay in the decision making and the actions that are being taken to get that water delivered as soon as practical.

VICE CHAIR BLEY: John, could you put up slide seven again? I know it wasn't - it's just a sample case. Oops.

MR. GRUBB: Maybe I can. Maybe I can't.

VICE CHAIR BLEY: This is - can you explain the general structure of this? And then I have a question or two.

MR. GRUBB: This was from my Monticello Plant. Monticello implemented the requirements of the spent fuel and FLEX orders earlier this year with one caveat. We do have a relaxation on the missile protection of the vent. Monticello's strategy credits our existing hard pipe vent for containment, venting containment, and it does not meet the missile protection requirements called up by the -

VICE CHAIR BLEY: I didn't want to challenge details.

MR. GRUBB: I know.

VICE CHAIR BLEY: I wanted to know the general structure.

MR. GRUBB: So if you look, this spring would be T0, so back it off of the spring elements we had. At about T9 is the first time we really introduced FLEX to the operators, about an hour and a half, all in the classroom, both licensed and non-licensed.

By that point, the site had developed our initial strategies. Our OIP had been submitted actually about a year and a half earlier. So this was kind of the first taste of what FLEX looks like for the operators.

A month later, we got into the basic. There was two industry CVTs that were put together, so we gave those to - the first one to both licensed and non-licensed, and then the second one just to the licensed operators.

At T6, we went into the classroom and walked through how the FLEX strategies work in conjunction with our existing station black out procedures, and the changes that were made to the procedures to help them detect the event, the extended loss of - the ELAP event earlier.

We talked about the mods that were being done to assist the, you know. At Monticello, they did two buildings that were separated. So we went through all of the mods, the procedures, the new equipment.

We did plant walk downs for the people that were going to be deploying the equipment out in the field, so they got to hook up the truck and tow the equipment out to the spot. They got to park it to tie into the, either the injection line, or for Monticello, it's repowering the batteries. Let's see.

VICE CHAIR BLEY: I can see the rest of it. You don't have any T+ a month or a year.

MR. GRUBB: I had that in my slides. I don't what happened to them on this. So we were getting FLEX training all the way up to just before the outage. So the last training cycle before the outage was the last of the FLEX changes.

Some of the things we covered there, as we were going through and developed our FSGs and things were going on within the owner's group, and plants were learning lessons as they went through implementation, we made changes to things that we may have presented earlier.

So we did do training all the way up right until, you know, the last training cycle before our

spring outage.

VICE CHAIR BLEY: Are you planning - and I know you have the usual training we have to get done for the highest risk issues. But are you planning to have exercises routinely in the future, and does everybody get some of that?

MR. GRUBB: Yeah, somebody asked a question about INPO earlier. I apologize, I don't remember who that was. But one of the things that INPO is doing is they're putting drill requirements in place through the SERs where we now will touch elements of the beyond design basis accidents through, at some certain frequency. I don't know off the top of my head what that is.

So I can tell you the last two drills that Monticello did, both of those used elements of the FLEX strategies although it wasn't really a FLEX drill. Because of what - the scenario, it led them into a place where they had the ability to deploy the FLEX equipment, and in both cases, they did that.

VICE CHAIR BLEY: And in the past, when we got the new operating procedures and emergency procedures and ran through those on the simulator, we found lots of places it didn't work and a lot of cleanup. Have you found places where the strategies

have needed some cleanup or rethinking as you go through?

MR. GRUBB: We've found a number of items. So what we did at Monticello is, you know, we completed our strategies sometime late last year. We didn't finalize them until we went through the - every operator had gone through the training.

So we captured comments throughout the entire training process, you know, the seven weeks, for all six crews, and then we did a final set of reps too. So we found a lot of implementation type of issues that we were able to fix before we had to finally implement.

VICE CHAIR BLEY: Okay, thanks.

MR. AMWAY: The other opportunity to catch that too is when we do our phase two staffing studies where you actually go through and do the, you know, the walk through of the procedures and the validations, that type of thing. It's also another opportunity where you can identify and catch those things and have time to correct them before implementation.

MEMBER SCHULTZ: All right, that's the end of the industry's presentation. Any comments or questions from the rest of the committee?

MEMBER RICCARDELLA: I just have one question. Could someone comment on any differences there might be between the actions being taken by the U.S. versus international via Mark I, Mark II BWRs?

MR. GRUBB: I attended an IAEA meeting in Vienna earlier this year that was all focused on lessons learned from Fukushima, a lot of it on the research side. But in general, I would say almost all of the European and non-U.S. plants, frankly, are implementing some type of a filter approach, not for a technical reason, for a political reason. That was talked about by a number of the presenters at that meeting.

MEMBER RICCARDELLA: And haven't they seen the data that shows that the filter doesn't do much?

MR. GRUBB: Well, both the BWR owners group and EPRI, as well as the NRC was at that meeting, and presented the data saying there's no technical benefit from the filters, which is why we went a different direction in the United States.

But the individuals that spoke at the meeting, these are the individuals - and then once I talked to between sessions, it was driven more politically than technically.

MEMBER RICCARDELLA: Thank you.

MR. WACHOWIAK: There was - we looked at some of the European Mark IIIs, and once again in Spain, there was a political decision to have the filter. And what they did was use an analysis similar to ours to help define what the design requirements for the filter were given that they had to have one.

MEMBER SCHULTZ: All right, at this point then the industry presenters will leave the podium as it were, and we'll go to the public comment presentations where the members of the public have requested time with the committee. John, could we have a break at this point?

CHAIR STETKAR: You know, Steve, you're running this portion of the meeting -

MEMBER SCHULTZ: Oh, thank you, so I would like to call a break -

CHAIR STETKAR: - so, yes, we can.

MEMBER SCHULTZ: - so that all presenters will be comfortable with their presentations and ready to go in about - at 3:30.

CHAIR STETKAR: So we're recessed until 3:30.

(Whereupon, the above-entitled matter went off the record at 3:19 p.m. and resumed at 3:31 p.m.)

AGENDA ITEM 2.2

MEMBER SCHULTZ: At this point by the clock it's 3:30, so we'll come back on the record. Thank you, John.

CHAIR STETKAR: The only reason I do that is they use it as a time stamp on the -

MEMBER SCHULTZ: We now have it.

CHAIR STETKAR: - transcript.

MEMBER SCHULTZ: And in this session we have presentations by members of the public who have asked the committee for an opportunity to present to the committee. And the first presentation is going to be by David Lochbaum from the Union of Concerned Scientists. Welcome to the forum, David, thank you.

MR. LOCHBAUM: Thank you, and good afternoon, and thank you for looking into this topic and also for allowing us this opportunity to share our perspectives with you.

We reviewed the staff's draft regulatory basis seeking to understand what the staff recommended, and also why they recommended it. After that review, we conclude that - we feel that the staff miscalculated the QHO benefits of Alternative 4, and calculated and then dismissed the non-QHO benefits of Alternative 4.

Step back a minute. If you look at Order

EA-13-109, it did not change the situation from being above the QHO goal to now being below it. In other words, the very low probability of this bad accident happening itself meant that nothing needed to be done to meet the QHO goal.

Therefore, EA-13-109 also met the goal and was ordered. Yet Alternative 4 is not being approved and was thrown aside because it too, along with everything else, does not - already meets the QHO goal.

We would agree with the staff and the commission now if the individual latent cancer fatality had been determined realistically and if it was the dominant factor. But we totally disagree with the staff and the commission's conclusion and the bizarre path to it.

There was discussion earlier whether rule making or ordering effects checkability by the NRC staff. Let me relate a big difference that affects the public. In rule making, the public has a right to contest the nonsense. In ordering, the public only gets to observe nonsense. We were deprived our due process by the decision to forego rule making for a wink, wink, nudge, nudge, say no more ordering with the staff.

When the orders were issued, there was opportunities by the public to contest the orders or intervene in the orders, but at that time, it was a bait and switch. We were told there would be a rule making to follow it up and we held our powder until that moment which has now been taken away from us, and we're not real happy about that.

This is Figure 4-24 from the draft regulatory basis, and it provided the consequence reduction factors for Alternatives 3 and 4 under four different emergency evacuation scenarios. The staff decided that CRFs of 3.1 to 6.0 were not enough to justify the cost of Alternative 4. I urge you to keep this point in mind because I'll return to it pretty soon.

While the staff looked at an unsuccessful evacuation scenario, their conclusion rested on confidence that evacuations will be 100 percent successful. The staff assumes that the trend -

MEMBER POWERS: Is that conclusion that they rest on 100 percent successful - I mean, there's a base line refusal to evacuate in most of the models. It's 100 percent successful save for that default value of the refusal to evacuate?

MR. LOCHBAUM: And the dead people too.

They don't leave either.

MEMBER POWERS: Well -

MR. LOCHBAUM: If you look at the first alternatives and what they considered in the base model for the conclusion, it was no value - there was essentially no radiation exposure avoided to the population within 10 miles, which basically translates into all of those people getting out of the way before the plume went by.

MEMBER POWERS: So they overload the default. There's a default level of people that refuse to evacuate.

MR. LOCHBAUM: That's the little band of people who didn't get out before the plume went by. If everybody had gotten out - but it's 100 percent successful based on the definition of what a successful evacuation is.

MEMBER POWERS: On what 100 percent successful is, yeah, okay, so they kept those -

MR. LOCHBAUM: The same -

MEMBER POWERS: - whatever the default value is for - by some sociologists on how many people would just adamantly refuse, there being contestations of that in the literature saying that that value varies in response to technological accidents. The

default value comes from all kinds of evacuations.

And some people would contest that it's a little too high because people in technological events, and by that they mean like, oh, in the south every once in a while they dump railroad cars of chlorine, that people over respond to those and under-respond to other kinds of things.

MR. LOCHBAUM: It's very magical because the people who are downwind evacuate. The people who are upwind, it's assumed that they don't evacuate and get in the way of those that are downwind, so it's a very magical process.

MEMBER POWERS: Well, I think they always assumed some sort of default value for shadow evacuations and - I mean -

MR. LOCHBAUM: It's assumed -

MEMBER POWERS: It's built into model that you've always had some fraction of those people who were not directed to evacuate did anyway, and therefore clog up arteries to some extent. I mean, I thought that always was built into the models unless you deliberately go in and override that.

MR. LOCHBAUM: Right.

MEMBER POWERS: Which is not easy to do.

MR. LOCHBAUM: That's my understanding

too.

MEMBER POWERS: Okay.

MR. LOCHBAUM: In the draft regulatory basis, the staff assumed that trained and qualified nuclear officials would only be 53 to 60 percent successful in preventing core damage using FLEX at all, but the untrained amateurs were nearly 100 percent successful running away from it.

MEMBER POWERS: I really did not understand that in your paper. It's in your - the people - I'm not sure who the amateurs are. The people that order evacuations and whatnot are the state officials. You can't call them amateurs. I mean, they're professional emergency preparedness trained. Sometimes it's the sheriff's department, but -

MR. LOCHBAUM: Right, but the people that, when they push that button and hit the evacuation siren, the people that are supposed to get out of the way have children in school. They have children -

MEMBER POWERS: Well, nearly all the school districts have emergency preparations and things like that. If the amateurs you're talking about are the citizens, then fair enough, but the people running the evacuation are not amateurs.

MR. LOCHBAUM: It's the people you're trying to protect. They have received essentially no training on this. It's assumed they'll do whatever those trained responders tell them to do. There's no training. There's no awareness. It's as assumption that's never been tested that these people -

MEMBER POWERS: Well, that's not quite true. We've done evacuations, certainly have done them in connection with Rocky Flats, and then there have been a few others like Crystal River and all of the - there have been a dozen or so. And it's hardly my area of expertise, but I've always been impressed that - at the level of compliance, shall we say.

MR. LOCHBAUM: Yeah, if you look at the data and throw out stuff like Hurricane Rita where people didn't get out in time, it all looks good. It doesn't - it's the various cherry picking. Those who are advocates of emergency planning and evacuations will pick the ones that people did get out, and they have excuses of why Hurricane Rita is a bad data point and gets to be thrown out. The science is not there to support that it's just 100 percent.

MEMBER POWERS: Hurricane Rita is a data point that I use in my class because it - I used to have a slide in my class about how the death rate, the

deaths due to evacuation itself as opposed to whatever prompting, were very low, and Hurricane Rita promptly forced me to throw that slide out because it really screws things up.

But I mean, I'm not sure what you mean by cherry picking. Even I average Hurricane Rita death rates in, okay, it doubled my death rates, tripled it maybe, that's still a pretty small number. And the evacuation rates, I mean, the problem is they're slow.

MR. LOCHBAUM: They're slow and you mentioned earlier the evacuation of the untrained amateurs. We citizens aren't consistent. We don't respond.

So the statistics on people who don't evacuate, employing the releases or whatever, those are not selected by proponents that are arguing that the evacuations are successful. There are reasons why all of these things don't apply because it wasn't a nuclear plant, or it wasn't whatever.

MEMBER POWERS: Well, I mean, the statistics on failure to evacuate chlorine are lower than they are for hurricanes. So when they average the two together, or in whatever magical way they decide to average, they actually get a number that some people contend are too high.

MR. LOCHBAUM: It's nearly 100 percent. -

MEMBER POWERS: Yeah, yeah -

MR. LOCHBAUM: - through the industry study.

MEMBER POWERS: Yeah, it's only about half a percent.

MR. LOCHBAUM: You can't take all of the data and throw out all of the bad points and still get 100 percent.

MEMBER POWERS: Well, I don't think - I mean, I'm not sure what bad point they're throwing out when you say that.

MR. LOCHBAUM: They're assuming nearly 100 percent evacuation except for those who refuse to evacuate.

MEMBER POWERS: Yeah.

MR. LOCHBAUM: That's the best they could possibly be. They're not accounting for anything less than the best that it could possibly be, and that's - I hope that's the case, but that's not good public policy. That's a convenient answer. It's not good public policy. If they choose to do it by a majority of votes and adopt bad public policy, so be it.

But when it doesn't represent reality and it assumes the optimum best assuming only those who

refuse to go get out in time, there's no way in the world as a scientific organization we can say, "Oh, yeah, there's sound reasoning behind that gimmick."

MEMBER POWERS: But you have statistics on what, 50 some evacuations? We have statistics on some evacuations.

MR. LOCHBAUM: I bet you look at the highest ones pulling that close to what the NRC is assuming for this case, but I won't know that answer yet anyway, so in the interest of time, I'm going to move onto my next slide.

MEMBER POWERS: Okay.

MR. LOCHBAUM: I mentioned earlier that the staff regulatory basis looked at the consequence reduction factors. Then I noticed that they only looked at that for the alternatives between - or for the differences between Alternatives 3 and 4. Table 4-24 from the draft technical basis provided the data for Option 1 or 2 as well, so I calculated the consequence reduction factor between 2 and 3.

For individual latent cancer fatality risks, that difference was - CRF was 2.27. For the difference between 3 and 4, it was 2.73. If you go across that table, in every single case the consequence reduction factor between the status quo

and the SAWA option is less, much less than the consequence reduction factor between 3 and 4.

The small, the allegedly small consequence reduction factor between 3 and 4 was utilized by the staff to say that Alternative 4 was not justified, yet they recommended Alternative 3 which had even smaller consequence reduction factors.

We also did an exercise based on the highest range cost for the external filter, $64 million, taking an assumed value of life of $5 million per dead person, then you roughly have to save - the external filter would have to save about 12 lives to be justified.

On this table, the staff provided the average individual latent cancer fatality risk for the SAWA case, Alternative 3, and the SAWA case plus the external filter which was Alternative 4. That delta is 9.5 times 10 to the minus fifth.

So if you multiply the delta ILCF factor of 9.5 times 10 to the minus fifth, times an effective population, divided by the cost, you have to figure out how many people could be exposed to that radiation level and be experiencing that individual latent cancer fatality in order for that $64 million to be justified. At $5 million per life, that number turns

out to be 134,737 persons.

Going back to your earlier question about what is the population around the plants, had the staff looked at the population within 10 miles and shown that there's only 20,000 people, so it's no way that they could not get out in time but that it would save 12 lives, but they've not done that. We'll do that once I get access to that data.

If you assume the value of a life is as high as $8 million, then it's 84,211 people who have to be exposed for that $64 million filter to be justified.

MEMBER POWERS: What did they use in their cost benefit? I don't remember.

MR. LOCHBAUM: The Office of Management Budget had been saying they've been using $3 million roughly.

MEMBER POWERS: That sounds about what I thought.

MR. LOCHBAUM: At that number, the affected population is 224,561 people who - what we're going to do is look at what percentage of the population within 10 miles do these numbers represent to try to come up with some conclusion. Is it reasonable that most of those people will be out?

Basically, what percent success rate does the evacuation have to be in order to keep the numbers below the value of life cost justified? So we'll - even though the commission has ruled, so it's a moot point, but we have a calculator and some time, so we'll do that.

But it disappoints us that we don't understand how the staff came to a conclusion that Alternative 3 was justified when its consequence reduction factors are less than that of Alternative 4.

The other thing we don't understand, and this goes back - on this slide. The lefthand column, as we understand, is doing nothing. I mentioned this earlier. And in the beginning and the middle in the next couple of columns is Alternative 3, which is what the staff recommended.

All of those are below the high level conservative estimate which the NRC panel said was the worst case, worst ELAP, and all of that stuff, so that's the worst of the worst. The NOC order which led to Alternative 3 being basically what's being happening was already below. How did the staff justify issuing the order for improvements that were below the QHO to begin with and ended up below the QHO at the end?

Given the fact that EPRI's data and the NOC's data shows very little variability amongst the individual latent cancer fatality for the various options, why is Alternative 3 the right one out of those options?

Why not go for Alternative 4 and also gain the huge economic benefits that it provides by not contaminating large parts of the American countryside? Why was that not factored into the evaluation?

None of these options, even the one that was ordered and the one that the NRC recommended, reduces the QHO below the QHO goal. They are already below that. So what game is being played on the American public by this bait and switch with doing an order and denying the public its opportunity for rule making? How in the world did that happen? What justified the order and how does that justification not mean we need to pursue rule making for Alternative 4?

It doesn't mean pursuing rule making means that you automatically have to adopt Alternative 4, but gives us, the public, a chance to recommend that, and it also gives us a chance to fight the NRC in court if they choose not to do that, but they took away that right.

I also had some comments about some things that perhaps should have been considered in Alternative 5, but in the interest of time, that's in the record in the material I provided. I think it's pretty straightforward. I'll omit covering that unless there's any questions over the reliability of the SRVs or any of the other issues. Hearing none.

MEMBER SCHULTZ: The next presenter for us, excuse me, the next presenter for us this afternoon is Paul Gunter from Beyond Nuclear. Paul?

MR. GUNTER: Thank you very much. Yes, my name Paul Gunter. I'm a Director of the Reactor Oversight Project at Beyond Nuclear. I'm going to make no pretense that I'm a technical expert on this, but we have - I've basically come before you representing the informed public, and we have also been active in interventions before the U.S. Nuclear Regulatory Commission.

And I think that that brings us to, well, perhaps the most egregious point in this rule making, is that I, you know, looking at the transcript from August 18, it's apparent to us that you, as the NRC's independent expert panel, were as blind-sided by the taking an informational paper from staff and turning it into a vote, that that was as much as - I would

suspect that would be as much a surprise to you as it was to the public in terms of the course that we were moving along, that it seems to have been an extreme waste of your time.

But it's - and I think that that is part of this very egregious decision which fails to uphold the concept of defense in depth, as well as Dave has pointed out, removes the public due process to present our own expert testimony. And, you know, let's make no bones about this.

By pulling this rule making, the commission basically voted to, in majority, to kick the public out of standing in any kind of legal challenge to a controversial issue that has now gone on more than four decades with regard to the unreliability of the Mark I and the Mark II containment, and it's consistent with this process of keep away.

And I've been around long enough to understand that it took a Freedom of Information Act through the Union of Concerned Scientists to reveal in 1978 the Hanauer memo recommending - where the AEC recommended we should suspend operations of these reactors and make no more.

You know, it took five years for that memo

to get out. And by that time, the AEC and the NRC had already proceeded down a path to license 16 more Mark Is. And it, you know, it just goes on that, you know, we, as the public, and public safety as monkey in the middle, has seen this ball go over our head time and time again.

Generic Letter 89-16 was done, as I've pointed out to you earlier, under 10 CFR 5059. It was treated like changing out the wastepaper basket liners in the control room. You know, it was basically presented to us as no significant safety issue. And by removing that, by turning it into a voluntary initiative for this industry, the public again was denied participation and a formal standing.

So now we arrive at, you know, our realization post-Fukushima that an affirmation of what we'd known already, where these containments are highly prone to failure. As was presented in 1986, it was a 90 percent chance of failure by Harold Denton. And, you know, if you are informed and following this along, you understand that if these containments are challenged, they will probably fail, and yet we have been denied standing all the way through the process.

Now, we arrived at a point with SECY 2012-0157 where to my surprise, there was - including

myself after study, there was broad approval of the staff decision to move to the filtered vent system. And there was an opportunity for the NRC to gain a consensus of public confidence that public safety was the primary concern, and that opportunity was lost here.

But in fact, it was picked up in Japan. And, you know, I just picked a couple of days here, several days where we were sort of flabbergasted by this about face that we saw where, you know, we had been awaiting the opportunity on the August 18 ACRS subcommittee meeting to meet and talk about some of these ideas.

That subcommittee meeting was predated by AREVA announcing that it was installing the 14th installation at Japanese nuclear power stations, and that was BWRs and PWRs with these filtered containment venting systems.

And so, the day after, you know, the ACRS subcommittee meets, we realize that the commission has in fact again taken an informational order, we believe out of context, and turned it into a vote. Now, granted, Commissioner Svinicki wasn't alone in that vote, and - but we were deeply surprised by the fact that the process that was moving forward was abandoned

so abruptly.

And again, it closed out your participation, you know, despite the fact that we, you know, were not in full agreement with your direction in this as well, but it removed our expert opinion on how these aging Mark I and Mark II containment systems will be managed in the next accident.

That said though, you know, we had known for a couple of years that the Japanese were proceeding with the filtration containment venting system. This is the schematic for the Shimane BWR. This is the schematic for Kashiwazaki-Kariwa.

Now, there was an NRC senior management team that went to Japan and reviewed this. I had the opportunity to talk to David Skeen who was, you know, quite impressed by the small footprint that these double-filtered containments was providing.

And you know, as the staff had recognized in the SECY 2012-0157, you have to take more than just the limited scope that we have by hypothetical analysis, and this is one of our big concerns is that - and this was also expressed in the notation vote of Chairwoman Allison Macfarlane in the vote on 2012-0157, where she explained that, you know, when you look at the hypothetical, when you look at the

probability assessments, it does not match up with what we are seeing in reality, and that the -

You know, the reality is that these containments if challenged will fail, and the failure trees are hypothetical and will be surprised. But, you know, we've made a choice now to limit the defense in depth, and the die is cast on this.

But again, it's particularly egregious that we are not getting an opportunity to address a lot of the uncertainties that have even been presented by the National Academy of Sciences where, if you look at their June 2014 paper through the Fukushima committee and their analysis, their Appendix L which looks at the factoring the costs of severe nuclear accidents and the backfit decisions, when they ran their assessment of the costs of Fukushima Daiichi, their figures were exceeding $2 billion.

And they raised the question in Appendix L, "It is instructive to compare these costs to the estimates developed by the NRC staff for a hypothetical accident at the Peach Bottom nuclear plant in Pennsylvania. These costs were used in the staff's backfit analysis for filtered vents."

And it goes on to say that, "The total estimate costs for the hypothetical accident at the

Peach Bottom plant are therefore $6 billion." So the NAS pointed out that that's about 33 - their estimate, their tally of this ongoing estimate was 33 times higher than the NRC estimate in its - in going by its quantitative analysis. And therefore, I think that that was part of the justification for also incorporating the qualitative analysis which put the filtered venting system into play.

But you know, and again, it is our concern that we're being denied an opportunity to bring in a whole host of independent expert analysis to challenge this on the record through due process. And I speculate that that is in good part why this rule making process was ended so abruptly in that it basically closes the record.

I just wanted to close with a couple of inclusion into the record here, the comments of Commission Jeff Baran in that he pointed out in his notation vote, "In my view, it is premature for the commission to consider the draft regulatory basis at this time without the benefit of public comment or the ACRS review.

I approve the staff's established plan based on clear commission direction to seek public comment and ACRS review of the draft regulatory basis

prior to its submission to the commission for a notation vote.

Furthermore, there is no reason for the commission to vote on the draft regulatory basis before the ACRS has reviewed and provided recommendations on the document. Under the staff's original schedule, the ACRS plan to hold a subcommittee meeting and provide a letter to the commission after the staff reviewed and addressed public comments for the draft regulatory basis.

The staff should resume this course though the staff previously presented the draft results of the regulatory analysis to the ACRS, this will be the first time the ACRS will examine the draft regulatory basis as a whole and share its thoughts with the commission. We should wait for the ACRS letter before making substantive decisions about the draft regulatory basis."

Emphasis here, "This is an important post-Fukushima rule making. A wide range of stake holders will have a variety of perspectives on the four alternatives presented in the draft regulatory basis. We should hear their views and critiques of these alternatives and the staff's regulatory analysis before taking any alternatives off of the table.

Therefore, consistent with the existing commission directive, the staff should carry out its plan to seek public comment and the ACRS review of the draft regulatory basis prior to submission to the commission for the next few months - in the next few months for a notation vote."

So just in closing, basically we feel that we - that this order, this notation vote was essentially effectively a gag order on the American public's ability and opportunity to formally provide input into severe accident mitigation efforts for the continued operation of the GE Mark I and Mark II reactors.

Ironically, the international nuclear industry is simultaneously cashing in on the effort to restart Japan's nuclear power plants where their nuclear regulatory authority has ordered state of the art engineered external filters on severe accident capable hardened containment vents as a prerequisite to resume operation.

And then that - you know, I provided this - the subcommittee with the AREVA press release, and that's part of your records. And, you know, I think the die is cast.

MEMBER SCHULTZ: Paul, we do have all of

that information available, and it's been available, made available to the committee already. Any comments or questions from the members? With that, I'd like - we're not done with the public comment period. We have one more to move forward. I wanted to thank David and Paul for your comments to the committee today.

At this point, for the members of the public that are on the phone line, Mary Lampert of Pilgrim Watch has requested time before this meeting, had made a formal request for time to make a presentation to the committee. She is on the public line, so we're going to open that line and allow Mary to make that presentation to us at this time.

There will be an opportunity for others on the telephone line to make comment following her presentation. But I'd like you all to reserve the time for Mary to make her presentation first. And so, if you could, please put your phones on mute except for Mary. Mary, are you there?

MS. LAMPERT: Yes, I am. Are the slides up?

MEMBER SCHULTZ: We do have the slides up, and David is at the computer. He could show the slides for you if you indicate when you're going to

move from slide to slide.

MS. LAMPERT: Certainly. Slide two, please. Good afternoon. I'm speaking from my home in Duxbury, Mass, which is located across open water about six miles from the Pilgrim Nuclear Power Station, a Mark I reactor. So I've a vested interest in this, and a vested interest in having a filter.

Slide three, please. The staff does not recommend filters, although we know other egress routes that you can have releases from are filtered. The staff reversed its course and they changed the way it performed as a cost benefit analysis, relied on flawed and unsupported assumptions, and used outdated consequence codes, the MACCS and SOARCA.

Slide four. As for the analysis of offsite economic consequences, the staff recommendation sent economic consequences of a release from a vent to the back of the bus. The staff did this because economic consequences indisputably show that adding a filter to SAWA would provide the most bang for the buck.

Table 4-23 before you on the slide shows that an $11 to $64 million filter saves $3.51 billion in economic consequences. And of course, the solution to this inconvenient truth was to give it considerably

less weight than it deserves. However, tell that to the agricultural industry that I can see now in Duxbury Bay that has a very large oyster farm.

Tell that to the cranberry growers. Tell that to the people whose investment is in their homes. Tell that to my three sons who are looking forward to a very sizable amount of money from the sale of this house when I kick the bucket, which will be sooner if I have to listen to what has gone before us.

Slide five. Instead of giving the offsite economic consequences their due, the staff prioritized health consequences and pretended that they would be essentially zero, although in fact, if an honest analysis had been done, they too would justify a filter.

How did they pull this magic trick turning offsite health costs to zero? First, they made the ludicrous assumption that evacuations will take less than six hours. Second, they assume that SAWA and SAWM, however you pronounce it, will delay releases to allow timely evacuation.

And thirdly, with no basis given, assuming it would be effective 60 percent of the time, and then conveniently, the staff ignored its admission that SAWA does not work 20 percent of the time. Third,

health costs become zero by limiting health impacts to cancer fatalities and limiting to a too small geographic area.

Slide six, please. First, let's look at evacuation. I can speak on this because I have been appointed by the town of Duxbury within Pilgrim's EPZ to review the radiological emergency plan and procedures each year. I have done this since the year 2000, so I know this subject.

Evacuations indeed will take far longer than six hours if the foolish assumptions the NRC uses are corrected. We first have to remember that when reactors were built, many of them like Pilgrim, etcetera, were built in less populated areas. They are now in more densely populated areas with an insufficient infrastructure, meaning that people are not going to get out of Dodge in time.

Also, many reactors are on large bodies of water such as the one I'm looking at. Therefore, you only have 180 degrees available for evacuation, not like a few reactors in the Midwest where it's not densely populated and there are evac routes around the entire circle.

So what NRC does is create fiction. Our emergency management director during Winter Storm Juno

here is on record saying it would take four days to evacuate the population. That is not less than six hours.

Slide seven. Some of the ridiculous assumptions in NUREG/CR 7002, which forms the basis for evacuation time estimates, and I presume, is what the staff relied upon to come up with this foolishness that evacuations will occur in less than six hours.

First, how do they judge public response? They don't tell them in telephone surveys that the questions are about a nuclear disaster, and hence they get false responses. That is what Sandia has done. That is what ALD that does the evacuation time estimates for reactors do in their telephone surveys, general question, "What would you do in any old evacuation disaster?"

However, what we have seen is by a telephone survey that was done here in southeastern Massachusetts that actually told people and asked the question, "What would you do in the event that there was a disaster at the Pilgrim Nuclear Power Station?"

Seventy percent said they would evacuate, and those respondents were from 10 to 25 miles distant from the reactor, so not the 20 percent from 10 to 15 miles that is assumed by the NUREG NRC, no, far

greater.

Then they asked specifically to those respondents, and all at the 95 percent confidence level, "What would you do if you were told that you were not in the EPZ, in other words, not to evacuate?" Fifty percent said they would evacuate. What does this tell us?

The assumptions of the shadow evacuation are wrong, so therefore expect a cork put in the bottle clogging the evac route. Then also, the segmented evacuation assumed inside the EPZ which is that everyone will obey, and only those directed to evacuate will evacuate having an orderly evacuation, letting those closer out first.

We know with today's communication capability that as soon - I tell you, as soon as I hear that there is a release or that the two mile around Pilgrim is told to evacuate, I won't hear that instantaneously either on email, on the phone, what have you, and I'm out of Dodge. That is clear.

And it is also clear another telephone survey that happened here in Duxbury was whether people could hear the sirens and the siren message. Seventy percent of those in Duxbury said, "No, we can't hear the siren message." So if you can't hear

the siren message or the siren, then how is a segmented evacuation going to occur?

And so assumption after assumption that brings about the fiction that you can have a timely evacuation, it has been shown to be bologna, and as a result of that, you will find that if you did an honest analysis, that the health costs indeed would increase.

Slide eight, please. This is a review on this slide. I don't have to repeat it for you. What it - of the Cape Cod telephone survey, which was paid for by Entergy by the way, that shows the 250 percent to 300 percent increase in the number of evacuees, which will bring about a huge increase in traffic density, a decrease in speed, and a dramatic increase in the evacuation time. This is proof in the pudding, an actual survey that shows the foolishness of the assumption that leads to the statement that ETEs will take less than six hours.

Slide nine, please. Last, the draft's own Figure 24, dash 24, shows the health benefits of adding a filter. The short columns to the right are SAWA and filter, plus the filter. They lead to a dramatic drop in latent cancer fatality risk, especially as evacuation time increases which are the

columns on the far right, or no evacuation at all.

Slide ten, please. The staff assumption of health costs equaling zero rests on another ludicrous assumption, and that is the assumption that SAWA will work 60 percent of the time. Also, the staff ignored that accidents that cannot be assumed to be slow breaking, that 40 percent of the time that the staff assumed SAWA would not work. And may I add any solution that purports to ensure public health and safety, even 60 percent of the time, is morally corrupt.

Next slide, please, slide 11. An example - I provide an example that SAWA is unlikely. There is no basis to assume it will work six out of ten times by pointing to Pilgrim's plan for supplemental water.

Entergy's proposed system here requires workers to bring a portable pump and flexible hose to a barge landing area to connect by a block pulley system to an installed mooring system in the barge landing area, and then the suction pipe supposedly will be connected to the pump on the tractor that will feed into a buried pipe providing coolant to the reactor.

What could go wrong? The real question

is, "What possibly could go right with this Rube Goldberg plan?" First, the truck tractor pump is housed in storage sheds in another - and obviously not located right by Cape Cod Bay. So the question would be, such as during Juno, a storm in January here, or the following one in February, or during another natural event where there would be a lot of debris, can the road be cleared to get the little truck, and the hose, etcetera, and the people down to the Bay?

Supposedly, this has to be - debris removal accomplished in six to nine hours. What does that do a timely evacuation? Then to get down to the barge landing area, there is a very narrow sandy road on the edge of the Bay, that supposedly this whole operation is going to be carried forth.

Take a 17-foot storm tide plus a 10-foot wave, and as the cartoon shows, you're going to have to work with the truck in the water. If that doesn't occur and they manage to get down there and stay on the road, what is the likelihood that this snatch block pulley system, you know, which you use to get your dinghy close to show, is not going to get clogged either with seaweed or with ice? The whole plan is ridiculous.

Slide 12, please. Last, the health

impacts were underestimated because the radiation health impacts that they looked at with cancer fatalities, they did not look at cancer incidents. They didn't look at reproductive disorders, other health impacts that they discussed in BEIR IV. They also ignored the likely geographic impact of exposure, and essentially by using a straight line and restricting it to 10 miles.

Slide 13, please. The third reason the staff analysis is not credible is that they relied upon a faulty cost benefit analysis and they used the outdated computer tools of MACCS and SOARCA. I think the cartoon says it all, that all of the numbers we've heard, and it's been mind numbing. You could say, "Hey, they don't lie," but luckily assumptions do lie.

And I'll slip to the next slide 14. And you can see there I've submitted papers previously to your group on what is wrong with the MELCOR analysis, quoting heavily from David Chanin who wrote the FORTRAN 4 code. I also was mystified on why the staff used MACCS and not a later so-called improved version of that code.

On slide 14, I've listed some of the ways in which the use of the MACCS served to underestimate consequences. For example, they only considered in

the code iodine, and in a small fraction, caesium-137. And Dave Lochbaum talked about the fact that NRC's value of life is $3 million where other agencies are using $5 million to $9 million.

Slide 15 discusses more ways in which the code - use of that code underestimates costs, particularly economic costs, although the staff analysis itself justified filters just based on economics alone.

Slide 16. I'm trying to go as quickly as I can to give other members of the public on the phone an opportunity. The slide 16 has the NRC's OIG audit report issued June 24, 2015. They found that the staff has limited costs estimates making it vulnerable to errors and flawed decision making. This analysis that has been done is a prime example.

The staff's flawed cost benefit analysis got the right answer for industry, but the wrong answer for public health, public safety, and the public's pocketbook. There is no way even this analysis justifies not recommending a filter.

It seems that the commission didn't like the answer the staff presented a couple of years ago to have a filter, the majority of the staff, but Chairwoman Macfarlane did. And so, the game was kick

it back for more study, which really said, "Get the right answer this time for industry."

And then the ground work to getting the right answer started to be put into play. "No, we're not going to have qualitative analysis. We're just going to focus on quantitative," even though there were papers by the NRC Jamali indicating all of the various uncertainties and unknowns that require looking at qualitative.

Oh, and as far as health, just yesterday there was a report. "Oh, we're going to cancel that cancer study around reactors because God forbid we might have the wrong answer." It goes on, and on, and on which means that the public has lost almost 100 percent respect for the NRC as an institution.

The public expects an accident because - here in the U.S. because that is the only thing that is clear will make - will shake up the NRC to get back to protecting the public and not the industry, and an accident is likely to occur in a Mark I, like the reactor I'm looking at right now.

So therefore, I say to the ACRS, do your job to protect the public, to bring the turnaround, if for no other reason than to start getting some respect back in the public for the agency, and also so you can

look yourselves in the face when there is the next accident. And I thank you very much for this opportunity.

MEMBER SCHULTZ: Mary, thank you for your comments. Any questions or comments from the committee? With that, what I would like to do at this point is to ask members of the public on the phone line who would like to make a comment to please state your name and make your comment to the committee. Is there anyone on the line who would like to make a comment? If so, please state your name and proceed.

MS. GOTSCH: Are the lines open?

MEMBER SCHULTZ: The line is open.

MS. GOTSCH: Okay, my name is Paula Gotsch. I'm a member of Grandmothers, Mothers, and More for Energy Safety. I would like to begin by saying the most intelligent thing I heard today. I think it was probably somebody from ACRS, maybe not, who mentioned the story of the statistician who drowned in a river with an average depth of six inches.

And that seemed to me to be the theme for the day in terms of what I heard in terms of all of this risk assessment and all of these things that are supposed to save us.

I also thought that the person who spoke

about, "Here is the order. Here is what we know we have to do. We have - we comply by doing A, B, or C." This is each individual plan. Now, where does the followup from that happen? How do we check to make sure that the plants not only do this now, but continue to do it? I thought that was, you know, reasonable of all of these things I've heard.

And I just want to say - hello? Hello, am I still on?

MEMBER SCHULTZ: We're still here or you're still there. Thank you.

MS. GOTSCH: Okay, I heard a funny noise. I didn't know what that was. Okay, I just want to say I'm in the Oyster Creek area. We had a forest fire over in the Pinelands yesterday, the day before yesterday. And then - now that's west of the plant. Now, we've been told most times, you know, that things blow out to sea.

Okay, so I'm now choking in my house from this smoke that you get from this forest fire. And I say smoke is what you would smell if you could smell radiation. You know, it's a good way to test your nose, what way the wind is blowing.

The next day I'm talking to my daughter-in-law who lives now in Monmouth County which

is northeast of here, and her house is suddenly full of smoke. Then I hear on the report that Queens and Brooklyn also got this smoke from the Pinelands, which shows that the plumes and the air currents, they do what they want.

It might also be a reason there's so much breast cancer on Long Island. I don't know. But in terms of this pat little idea of protecting the public in the event of an emergency and they'd all come out fine, that is totally beyond comprehension.

Okay, now Oyster also, the reassurance that there would be all of these training programs for these people that are supposed to run around with their flashlights or whatever they're doing to do all of these things that have to happen in an emergency, the reassurance of the training continuing.

I will say that Exelon ended up being cited three times by the annual inspections for their members not - their workers, some of them, not following procedures. They were, you know, those cute little things. They have white, yellow, and green, whatever, findings that don't seem to mean very much in the long run.

They were guilty of, I think it might have been a white performance malfunction there. And I'm

not going to start knocking the workers. I don't know what kind of training they get. All I know is that the turnover is very often.

I've been told by some of the plant people that I know that the institutional memory is shot on that plant which is the reason they kept putting the wrong cables, the safety cables, they kept putting the wrong ones in for three times, which was considered a yellow, by the way.

So there was a problem of institutional memory going on in these plants. The fact that -another thing is now you've got high burnup fuel in those plants. That raises the temperature on an accident I would imagine tremendously.

And then I also was surprised to hear such an unscientific statement from somebody saying that the reason they have the filtered vents in Europe is political because he heard it from some of these speakers. I don't think Frank von Hippel is an idiot. He is a very smart professor from Princeton who has been around a long time, top of his field, who wrote an article about the importance of filtered vents. I don't think that man is political at all. He doesn't have a political bone in his body.

So I think, you know, hearsay on something

and getting the false, you know, this false feeling that all of these filtered vents are going in in Europe because it's political since Fukushima, actually some of those filtered vents were already in there before Fukushima until some people figured out, "Hey, they might save a few people."

So in terms of - and I will agree with Paul totally. You cheated us out of our chance to have something to say about what you're saying, to do this FLEX program. It sounds like - it does sound like a Rube Goldberg.

And the other thing is - oh, something someone said - I wrote everything down that made me - that there is no sense putting filters on because the stuff leaks out other passageways and you can't filter them. Another reason to show that this plant is not fulfilling the responsibility nuclear was supposed to have to protect the people from the radiation.

We were supposed to have a leak tight containment. We weren't supposed to have all of this stuff leaking out all over. We know that there's been tremendous amounts of radiation in the past released from Oyster, I mean, millions of whatever you call them, curies or whatever you want to - I don't know what the heck you call them now. All I know is it's

bad.

And so therefore, number one, you shouldn't even be operating these plants. And you know what else occurred to me? You're all trying to - you know, arguing over how to do this for now, how many years since Fukushima? And saying, "Oh, we should do this. We should do that." That meant that all of those years before Fukushima we - no one would have known what to do if there was an accident here.

We wouldn't have been any smarter than the Japanese. And in terms of - I really believe that you're sitting there thinking, "Oh, but what are the chances this is going to happen?" Well, you know what? How long can we keep our fingers crossed? This could happen.

And I want to agree with Mary. When will we get someone who when the buck gets to the - and I'm talking to ACRS here. And I'm saying some of you are smart because you have that smart thing you said about A, B, C, and where do we find out the compliance, and I loved the story about the guy who drowns in a river with an average of six inches.

Some of you are smart enough to know b.s. when you hear it. And so, someone's got to stand firm and stop it, and say, "Give these people their

hearings. Give them their legal rights," and not let this b.s. continue. And I really appreciate the time.

MEMBER SCHULTZ: Thank you, Paula. I appreciate your comments. I would like to ask anyone on the phone who would like to make a comment to please identify yourself and make your comment. I'm listening. If you are on the phone and would like to make a comment, please state your name and do so.

Hearing none, at this point we will close the phone line. But I'd like to ask if there are members of the public in the audience here in the meeting room to - if you'd like to make a comment, to come to the microphone and do so. Seeing no one taking advantage of that, I would like to close this session and turn the meeting back over to you, John.

CHAIR STETKAR: Thanks very much, Steve. I did, because we do have a number of members of the public who are obviously very interested in these issues, I wanted to make you aware that on August 27 the commission did issue a staff requirements memorandum for SECY 15-0065 instructing the staff to go ahead with issuing proposed rule making regarding mitigation of beyond design basis events which does explicitly address the core damage prevention aspects of FLEX.

So the public will have the opportunity as part of that rule making package to certainly provide review and comments on that aspect of the FLEX proposals.

Now, I didn't know whether members of the public - I wanted to take the opportunity because it is relatively recent within the last two weeks anyway. So that will - I don't know when it will be issued for public comments, but at least the commission has approved its issuance.

And with that, unless there are any other comments from members of the committee - I'd again - I'd like to personally thank everyone that we've heard from this afternoon. I think it was a very good discussion. I think we do provide a forum for the public to express their concerns and place their concerns on the record.

We do consider very seriously the input from the public, and we'll do that in our deliberations. And with that, we are adjourned. I'm sorry, we are - I always get that wrong. We are off the record and we are recessed for this portion of our meeting.

(Whereupon, the above-entitled matter went off the record at 4:41 p.m.)

U.S.NRC
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Protecting People and the Environment

ACRS Full Committee Meeting: Containment Protection and Release Reduction Rulemaking

September 9, 2015

U.S.NRC
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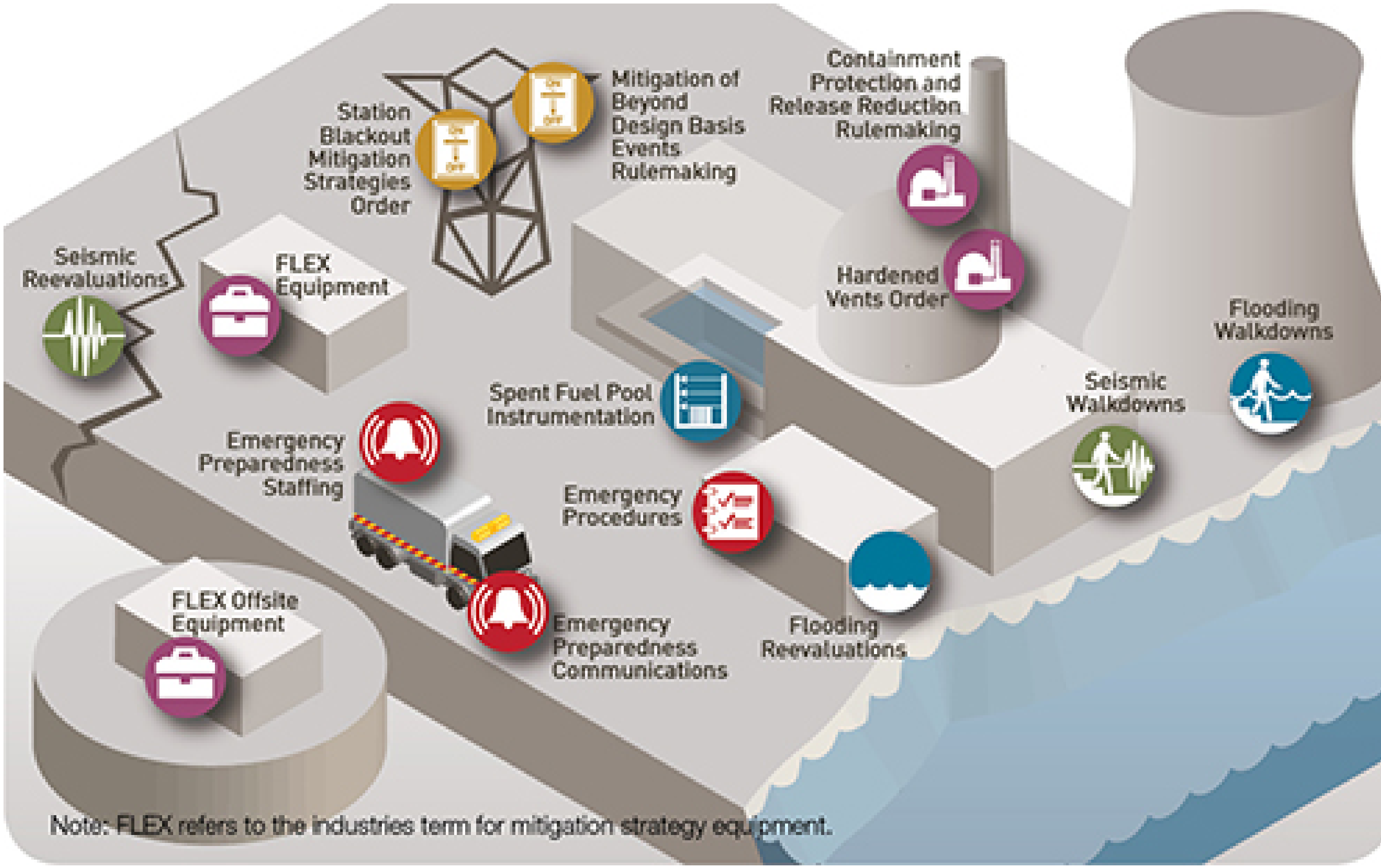
Protecting People and the Environment

Background

NRC Activities to Address Fukushima Lessons Learned



Order EA-13-109 and CPRR Rulemaking

Containment Protection

- Alternative 1 (no rulemaking – status quo)
  - Order EA-13-109 for overpressure protection
  - SAWA/SAWM for Phase 2
    - Establishes design conditions & supports wetwell level control.
    - Collateral benefit of core debris cooling.
- Alternative 2 (codify order)
  - Core debris cooling remains collateral benefit.
- Alternative 3 (codify order plus require SAWA)
  - Rule for protection against major containment failure modes.

Release Reduction

- Alternative 4 (engineered filter/filtering strategy)

Commission Decision SRM for SECY-15-0085

- The Commission directed the staff to not issue the draft CPRR regulatory basis for public comment.
- The Commission approved Alternative 1, Order EA-13-109 implementation without additional regulatory actions.
- The staff should leverage the draft CPRR regulatory basis to the extent applicable to support resolution of the post-Fukushima Tier 3 item related to containments of other designs (Near-Term Task Force Recommendation 5.2).

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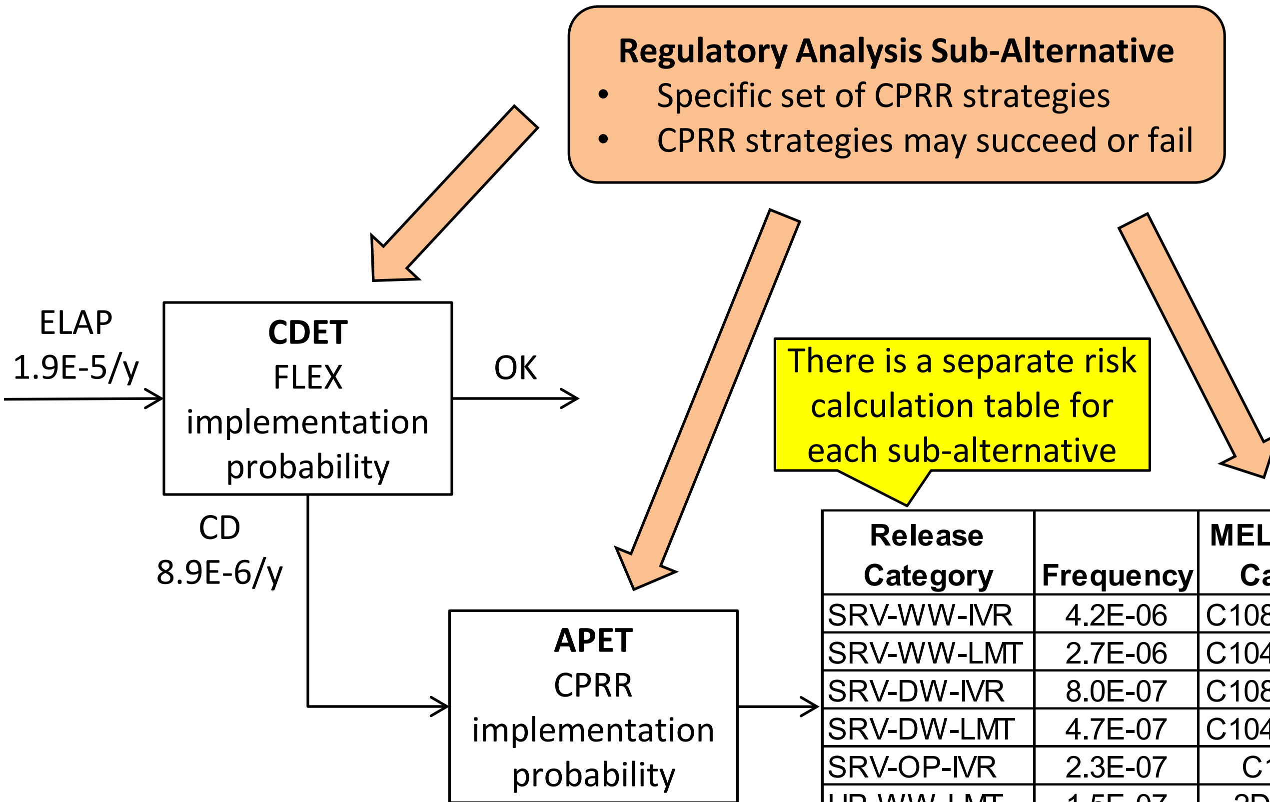
CPRR Rulemaking
Evaluation of Alternatives

- Technical Analyses
  - The technical analyses demonstrated that the reduction in risk was not a substantial safety improvement per the backfit criteria.
  - Consideration of Severe Accidents.
    - Low Frequency-High Consequence Events with low estimated risks to public health and safety.
    - Quantitative Health Objective Limit ≈ $2x10^{-6}$ vs. CPRR High-Level Conservative Estimate ≈ $7x10^{-8}$
  - Evaluation of alternatives considers factors such as the performance of other response capabilities (i.e. FLEX equipment, Operator actions, etc.)

Example Risk Calculation



Example: Sub-Alternative 4Bi(1)

Release Category	Frequency	MELCOR Case	MACCS Bin	Conditional Consequence	ILCFR
SRV-WW-IVR	4.2E-06	C108DF10	123	7.4E-05	3.1E-10
SRV-WW-LMT	2.7E-06	C104DF10	110	2.5E-04	6.7E-10
SRV-DW-IVR	8.0E-07	C108DF10	123	7.4E-05	5.9E-11
SRV-DW-LMT	4.7E-07	C104DF10	110	2.5E-04	1.2E-10
SRV-OP-IVR	2.3E-07	C108	122	1.3E-04	2.9E-11
HP-WW-LMT	1.5E-07	2DF10	10	4.1E-04	6.1E-11
SRV-OP-LMT	9.9E-08	C104DF10	110	2.5E-04	2.5E-11

Total ILCFR for Sub-Alternative 4Bi(1) = 1.3E-09

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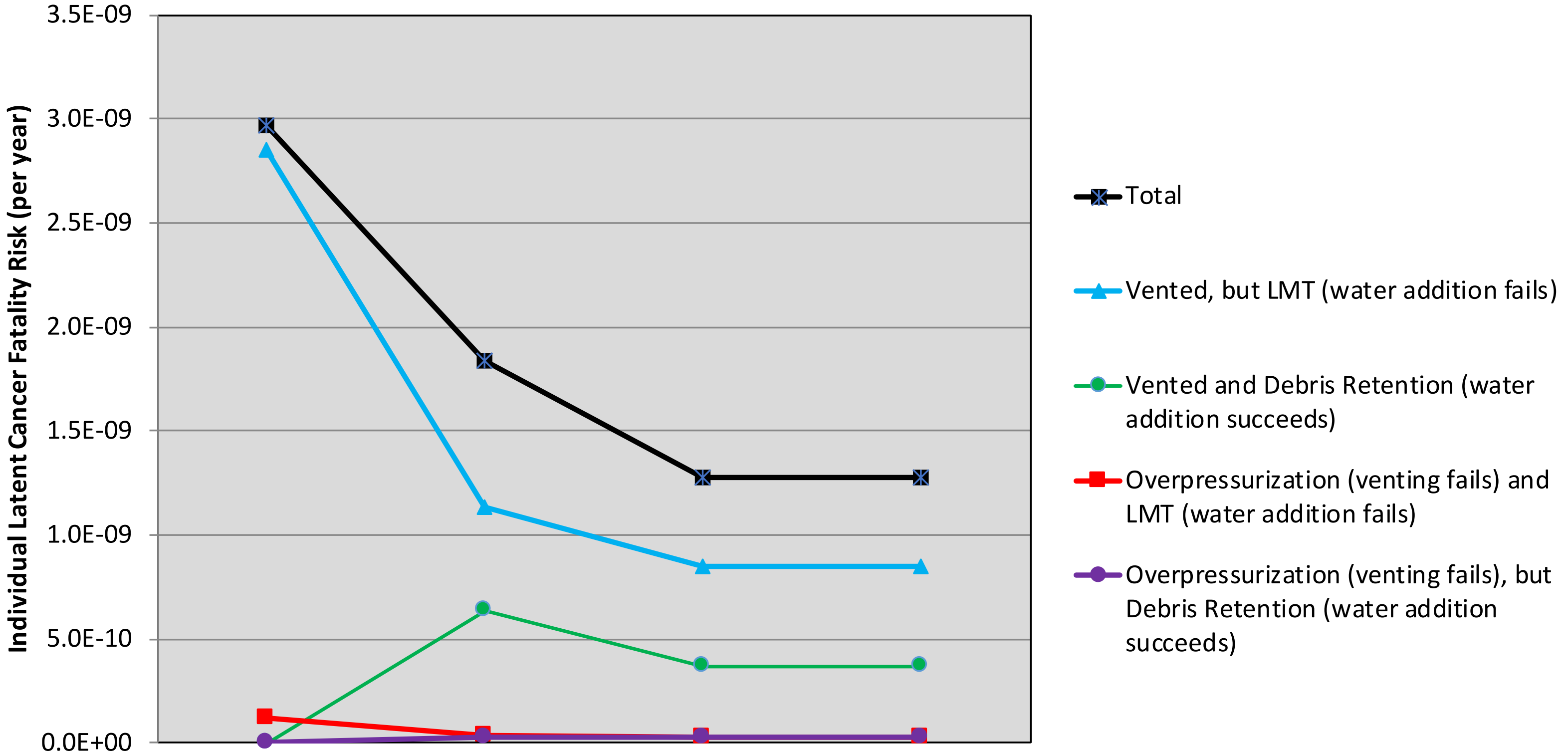
Contributions to Risk



Sub-Alternative	1	3A	4Bi(1)	4Ci(1)
water addition capability	no	yes	yes	yes
filter	no	no	DF=10	DF=1000
CCFP	100%	42%	42%	42%

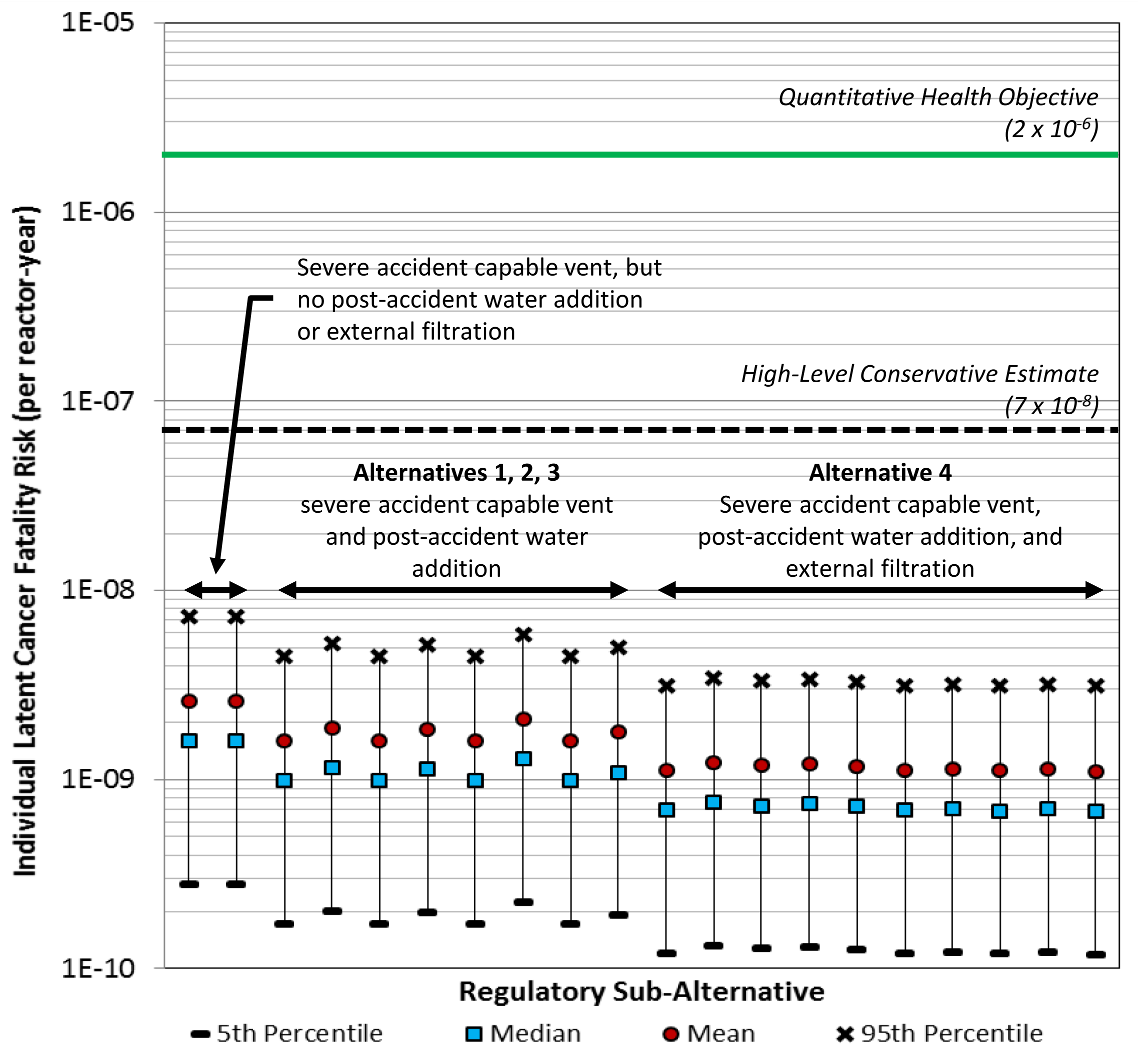
CCFP = conditional containment failure probability (overpressurization and/or LMT)
LMT = liner melt-through

For each sub-alternative:

- Injection pathway: RPV
- Water strategy: severe accident water addition (SAWA)
- Vent priority: wetwell first
- Vent control: manual
- Vent strategy: open-and-leave-open

Comparison to NRC Safety Goal

- Frequency-weighted individual LCF risk is orders of magnitude below the NRC Safety Goal QHO
- High-level conservative estimate using highest ELAP frequency and highest conditional LCF risk about 30 times below QHO
- Risk reduction from regulatory alternatives are within uncertainty bounds



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CPRR Conclusions

- CPRR rulemaking activities have been discontinued.
- The staff is planning to issue a NUREG technical report to document the completed CPRR analysis.
- Proceeding with licensee implementation and NRC oversight of Order EA-13-109.

Containment Protection and Release Reduction Rulemaking Regulatory Evaluation

Advisory Committee on Reactor Safeguards

September 9, 2015

BWR OWNERS' GROUP

NUCLEAR ENERGY INSTITUTE

Commission Decision Supports Safety

- Decision to implement Order EA-13-109 without additional regulatory actions focuses both the NRC and industry resources on what is truly important for safety
- The 29 affected plants are already taking actions to protect BWR Mark I and II containments using industry guidance endorsed by NRC pursuant to the Order.
- Supports the critical regulatory principle that decisions should be based on quantitative evaluations and "qualitative factors should only inform decision making in limited cases when quantitative analyses are not possible or practical." [SRM-SECY-14-0087]
- The CPRR Rulemaking quantitative analysis fully supported not taking action to require external containment filters on BWR Mark I and II plants.

ELECTRIC POWER RESEARCH INSTITUTE

Technical Evaluations of CPRR Strategies

Rick Wachowiak (EPRI): EPRI Project Manager

Advisory Committee on Reactor Safeguards
September 9, 2015

CPRR Rulemaking

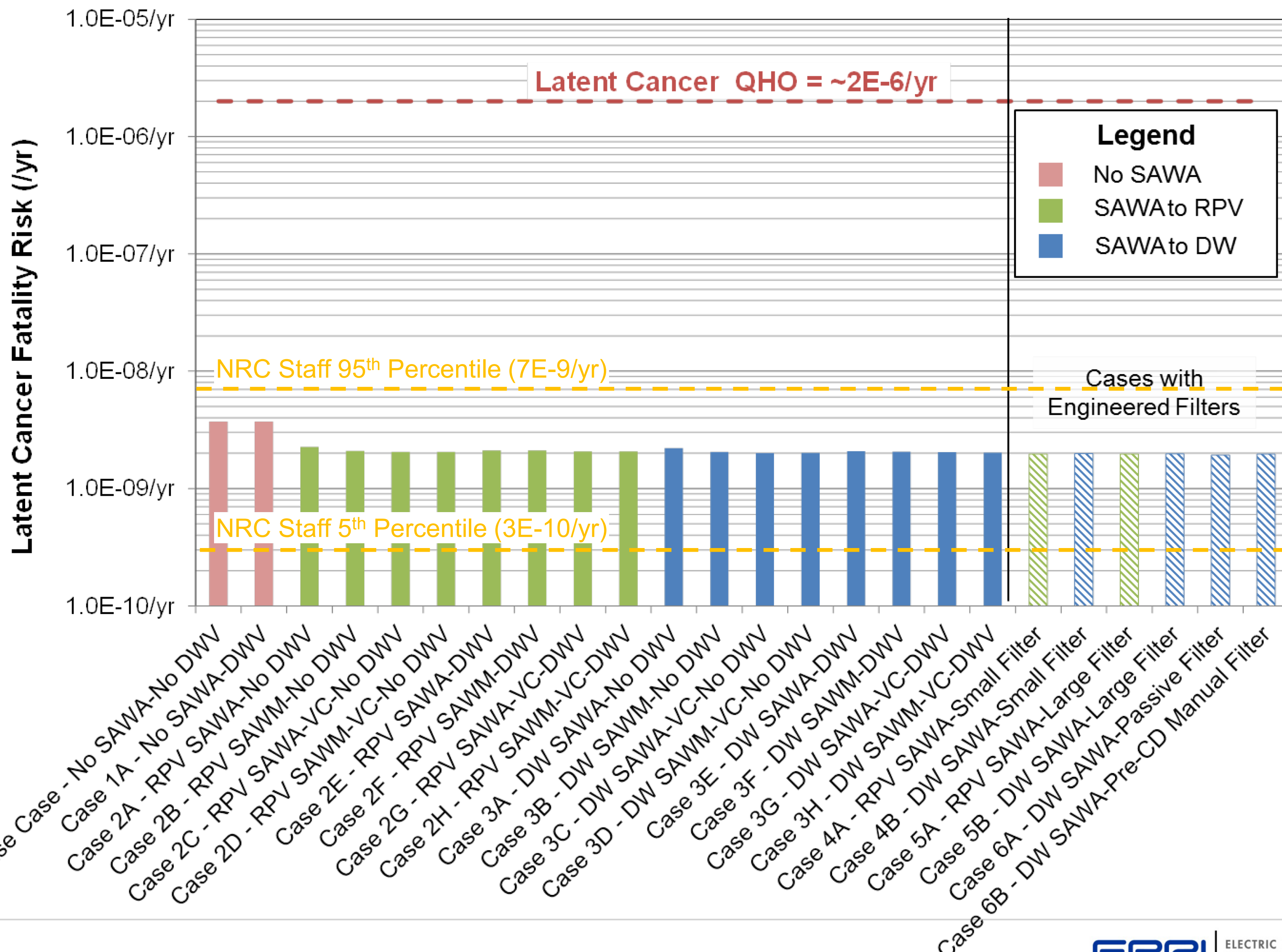
- Evaluation of the residual benefits of filtering strategies should be made in the context of an effective accident management capability and focused on the dominant accident scenarios
- Industry has always viewed the CPRR Rulemaking in the context of accident management
  – Response to postulated severe accidents like the accidents at Fukushima requires operator action
- Accident management involves:
  – Cooling core debris
  – Managing decay heat
  – Mitigating releases

Objectives of EPRI Evaluation

- Consider a comprehensive set of extended loss of ac power (ELAP) scenarios in a probabilistic framework
- Understand the role FLEX plays in ELAP mitigation
- Understand dominant severe accident scenarios
- Develop clear, manageable analysis of filtering strategy alternatives
- Support open dialog with NRC staff on assumptions, technical issues, dominant scenarios, and insights
- Inform the implementation of EA 13-109 (to the extent feasible)
- Providing insights to BWROG on EPG/SAGs
- Support industry decision-makers on the cost-benefit considerations

Technical Basis for Severe Accident Mitigating Strategies: Volume 1. EPRI, Palo Alto, CA: 2015. 3002003301.

Example Results: Latent Cancer Fatality Risk



ELECTRIC POWER RESEARCH INSTITUTE

Insights

- Essential role of the operators
- Importance of water addition
- Incremental benefit of engineered filters
- Totally passive vent shown to increase core damage frequency (CDF)
- Sensitivity cases confirmed that the margins identified in the base results are not challenged by uncertainties

Conclusions

- Adoption of severe accident water addition strategies provides the greatest overall safety benefit, both in terms of protecting containment and reducing releases
- Manual actions would be required to manage the severe accident for all strategies
- Other alternatives investigated provide negligible additional benefit to public health and safety

Together…Shaping the Future of Electricity

EPRI ELECTRIC POWER RESEARCH INSTITUTE

Preparing BWR Operating Crews for Beyond Design Basis Events

Advisory Committee on Reactor Safeguards

September 9, 2015

BWR OWNERS' GROUP

BWROG

- Mission of BWROG

  Provide a forum for member utilities to improve plant safety, improve reliability, minimize & share costs, and facilitate regulatory interaction.

- All US BWRs are members

- All international BWRs are eligible to be members, currently there are 12 international participants

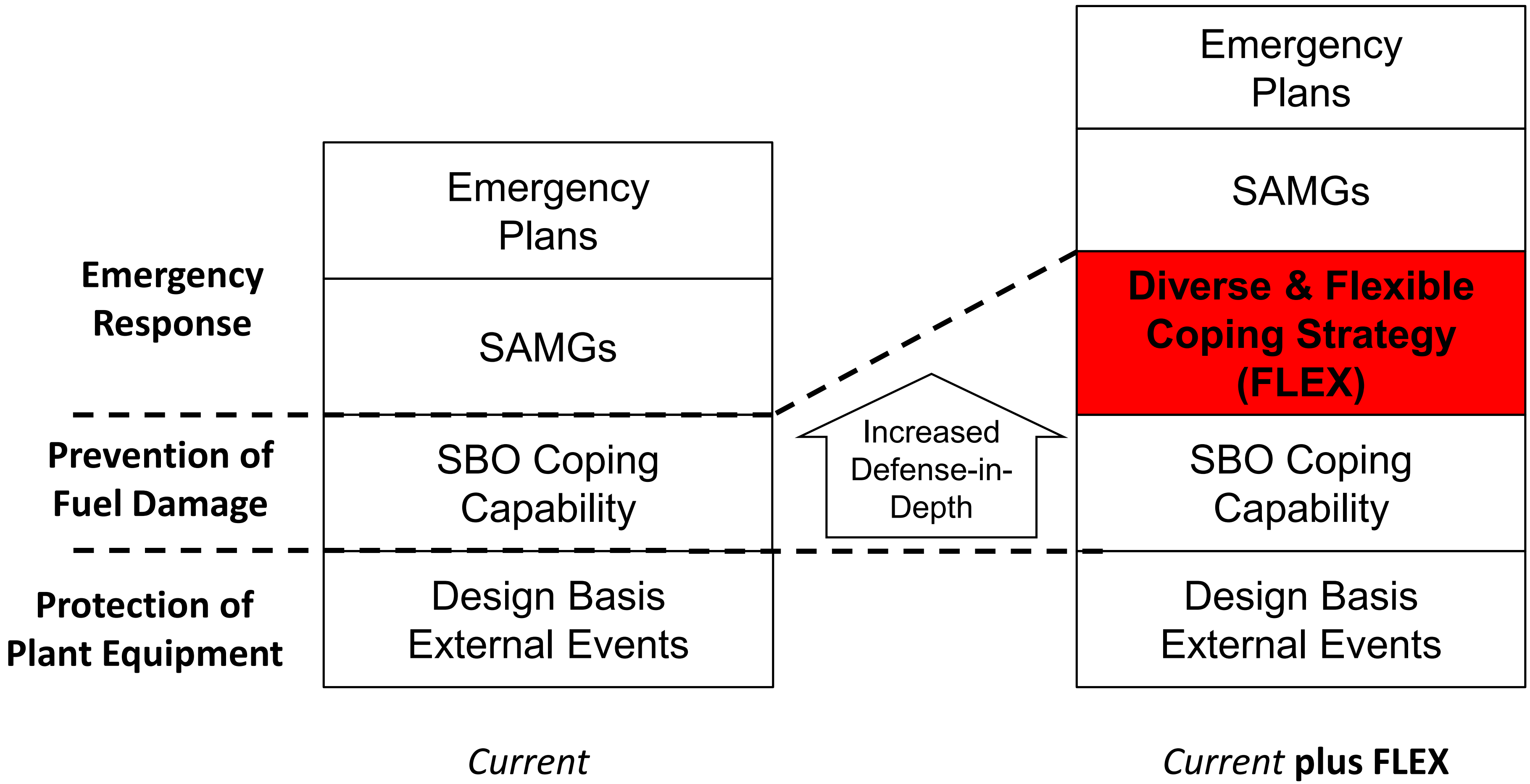
Fukushima Subcommittee

- Fukushima Response *ad hoc* committee formed in late 2011
- This committee worked with the existing Emergency Procedures Committee (EPC) and EPRI to develop FLEX Support Guidelines (FSGs) criteria
- These procedures work in conjunction with the station EOPs and SAMG
- Each plant used the generic FSGs criteria to create plant specific FLEX procedures for response to BDB events

Emergency Procedures Committee

- Expert participation from all US and several international BWRs
- Improve plant operations and safety by taking into consideration the events at Fukushima
  - EPG/SAGs; FLEX Guidance (FSGs)
- Experience and information sharing and worldwide workshops
  - Revision 3 EPG/SAG workshops to facilitate a uniform understanding of revision and their technical bases among the members
  - Technical Support Guideline Skill Set workshops with case studies
  - Severe Accident Workshops with case studies
- Advises the BWROG and utilities on issues related to emergency response strategies
- Maintains guidelines and associated appendices, issue files, conference reports, analyses, etc.

FLEX Support Guidelines

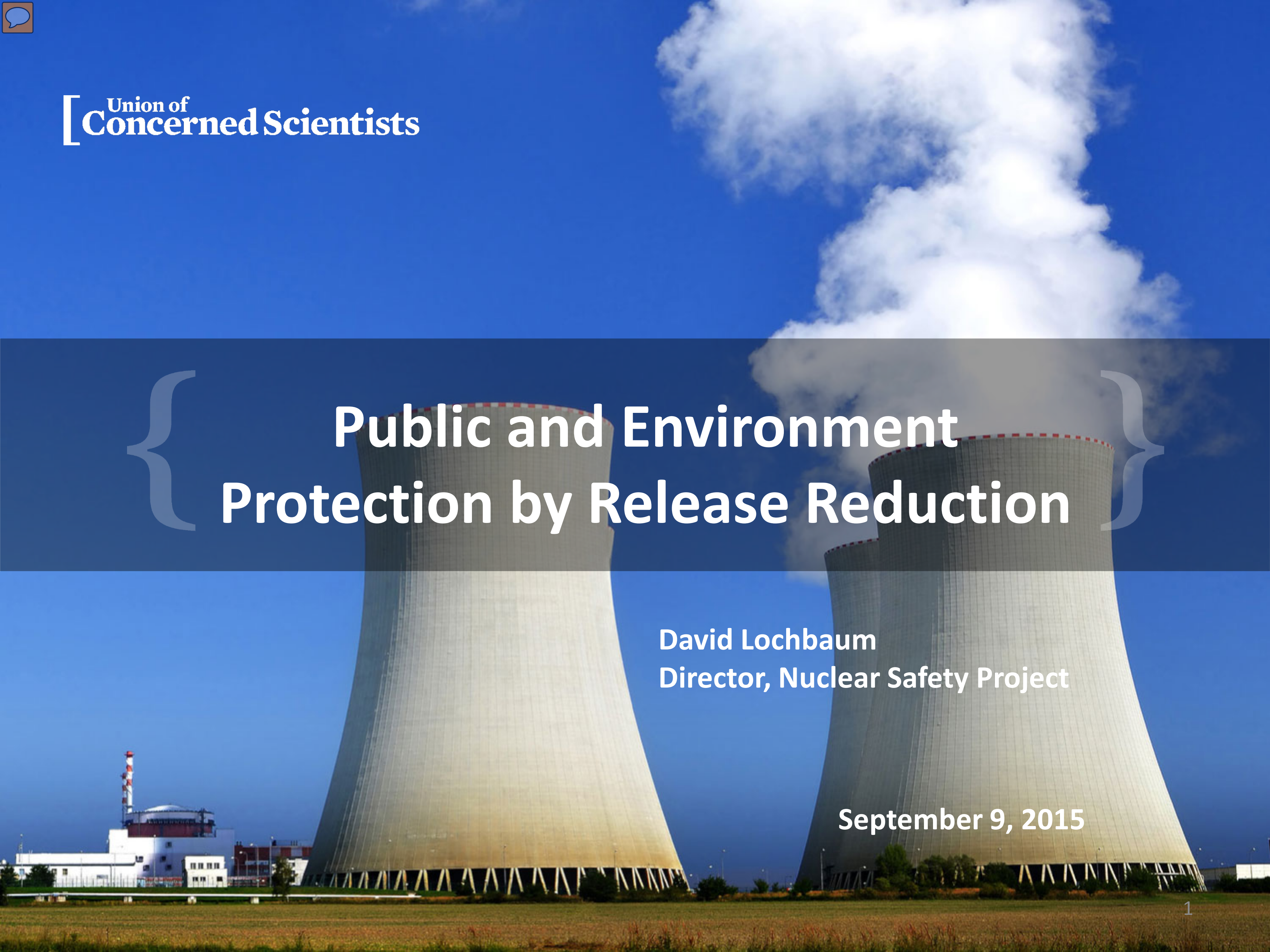


Operator Training

- Each plant used the generic FSG criteria to create plant specific FLEX procedures for response to BDB events
- Operator training was developed and delivered for the new procedures and overall FLEX concept prior to plant being compliant with FLEX Order
- FLEX and BDB training added to the Operations training program

Back Up Info

- **Operator Training**
- **T-9 months:**
- FLEX Introduction (1.5 hours CR for all licensed and non-licensed Operators)
- *Provided the basics of Site response strategy as well as definitions, assumptions, etc.*
- **T-8 months:**
- Basic FLEX (1 hr Industry CBT for all licensed and non-licensed Operators)
- *Industry developed overview of the FLEX concept and the Lessons Learned from Fukushima*
- Advanced FLEX (1 hr Industry CBT for all SROs)
- *Industry developed generic discussion of SAFER response and timelines as well as leadership under stressful situations*
- **T-6 months:**
- FLEX Classroom SBO Overview (15 hours classroom for all Operators)
- *Site modifications, procedure changes, and new procedures for FLEX.*
- In-Plant Walkthroughs (4 hours for Non-Licensed Operators)
- *Focused on initial site assessment, deployment paths, staging concerns, equipment maneuvering and operation*
- SBO and FLEX Simulator Exercises (4 hours simulator for all Licensed Operators with Non-licensed Operator participation)
- *Simulator scenarios designed for SBO and ELAP implementation efforts*
- SBO and Flowcharts (Los)
- *AOP training on SBO and use of the C.5-4000 SBO Guideline; presented the integration of EOP activities into AOP/FLEX activities*



Union of Concerned Scientists

Public and Environment Protection by Release Reduction

David Lochbaum
Director, Nuclear Safety Project

September 9, 2015

Draft Regulatory Basis for Containment Protection and Release Reduction for Mark I and Mark II Boiling Water Reactors

(10 CFR Part 50)

U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Office of Nuclear Regulatory Research

May 2015

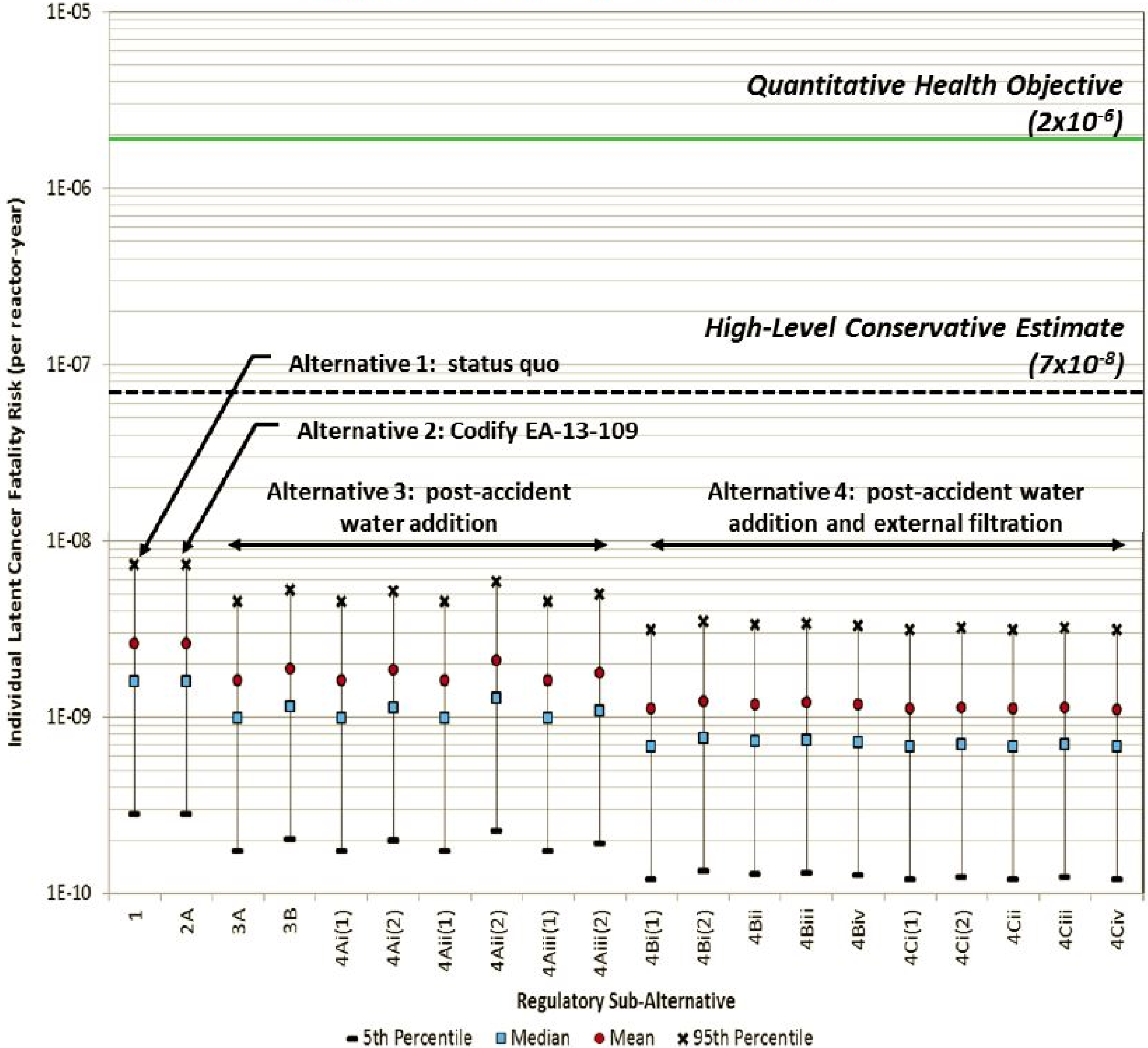
Sources: Unless noted otherwise, all graphics and text quotes in this presentation are from this document (ML15022A214)

3.5 Regulatory Evaluation Conclusion

Based on the considerations discussed above, the staff is planning to pursue a rulemaking to make the requirements of Order EA-13-109 generically applicable, with an additional requirement for the use of SAWA/SAWM (i.e., alternative 3). This approach would provide the administrative benefits described for alternative 2, while also including the potential synergistic severe accident mitigation opportunities associated with SAWA/SAWM. Unlike alternative 4, a rulemaking to make Order EA-13-109 generically applicable with additional requirements for SAWA/SAWM seems unlikely to have significant additional costs for licensees because, as far as the staff is aware, licensees are currently planning to adopt SAWA/SAWM strategies as part of the implementation of Order EA-13-109. Alternative 4 would provide some additional safety enhancements, but as discussed above provides only minimal safety benefits with regard to the QHOs while having a significant cost of development and implementation.

The Regulatory Analysis of Alternative 4 miscalculated QHO benefits and essentially neglected all non-QHO benefits.

Figure 3-3: Uncertainty Bounds for Individual Latent Cancer Fatality Risk



- If core damage occurs, there would be a release due to containment venting and/or containment failure caused by over-pressurization or liner melt-through for all CPRR alternatives. However, the estimated mean individual latent cancer fatality risk (0-10 miles) is more than two orders of magnitude below the relevant NRC Safety Goal Quantitative Health Objective. The risk is low because the core-damage frequency is low and the conditional latent cancer fatality risk is low.

If the individual latent cancer fatality risk had been determined realistically and if it were the dominant factor, UCS would concur with the Regulatory Analysis that Alternative 3 was the way to go.

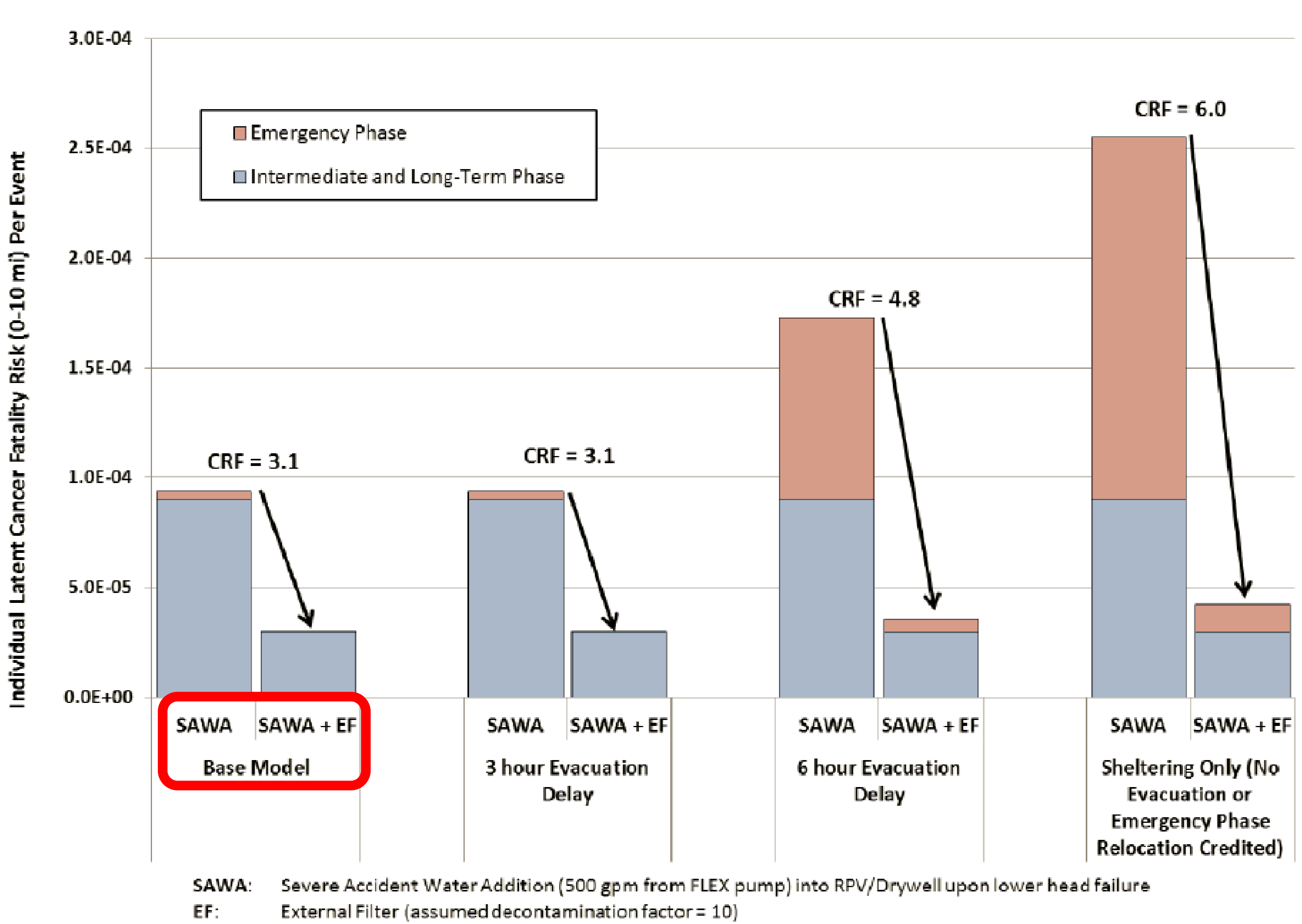
But it is not and we do not think Alternative 3 is the right thing to do.

ILCFs Not Determined Realistically

- Assuming protective actions are taken in the intermediate and long-term phases, the ILCF risk is maintained at a level well below the QHO, when multiplied by the accident frequency.

Regulatory Analysis unrealistically assumed that protective actions would be nearly 100% reliable in evacuating individuals before they were exposed to significant levels of radioactivity.

Figure 4-24: CRF for Conditional ILCF Risk (0-10 mi) for Evacuation Sensitivity Calculations for BWR Mark I MELCOR Case 49



ILCFs Not Determined Realistically

As Figure 4-24 in the Regulatory Analysis shows, the NRC's base model assumed protective actions (i.e., evacuations) would be ~100% successful.

Figure 4-24 also shows that less than 100% success results in larger individual latent cancer fatality risks during the emergency phase than for ALL phases examined by the base model.

The Regulatory Analysis's conclusion relies on a non-validated assumption of ~100% success.

Figure 3-1: Calculation of High-Level Conservative Estimate

ELAP Frequency

- Highest ELAP frequency of all U.S. Boiling Water Reactors with Mark I and Mark II containments: 7.4×10^{-5} per year

FLEX Equipment Success Probability

- Success probability of FLEX equipment in preventing core melt: 0.6 per demand

Conditional ILCF Risk

- Highest conditional individual latent cancer fatality (ILCF) risk within 10 miles: 2.2×10^{-3} per event

Conservative Estimate

- Conservative estimate of frequency-weighted ILCF risk within 10 miles: 7×10^{-8} per reactor-year (~30 times lower than 2×10^{-6} QHO)

- The evaluation assumed that 60 percent of the time the pre-core-damage water addition (FLEX) will be successful in preventing core damage. This assumption is informed by the results of the risk evaluation, which used scoping estimates of human error probabilities, and the NRC review of licensees' mitigating strategies, including plant walkdowns. Half of the failure probability is due to failure to implement needed operator actions and the remaining half is due to equipment failures.

4.2.4 Summary of Technical Approach

The core-damage frequency (CDF) due to ELAPs is calculated to be 8.9×10^{-6}/ry, which is 2 times lower than the value of 1.6×10^{-5}/ry that was estimated for SECY-12-0157. The CDF was calculated by averaging together the CDF for each BWR plant that has a Mark I containment and a RCIC system. As shown in Figure 4-2, "Contributions to ELAP Frequency and Core-Damage Frequency," the internal event ELAPs and seismic ELAPs caused by earthquakes with peak ground accelerations ranges from 0.3 to 0.7g are notable contributors to the CDF. Figure 4-2 also indicates that the conditional core-damage probability (CCDP) given the occurrence of an ELAP is about 47 percent (i.e., the SBO mitigation strategies reduce the CDF by about 53 percent).

Highly trained nuclear professionals are only assumed to be 53-60% successful in preventing core damage. Untrained amateurs are assumed to be ~100 successful in running from it.

The Regulatory Analysis seems to be evacuating the wrong individuals.

Why not evacuate the nuclear professionals and let the amateurs apply their talent, skill, or luck, to preventing reactor core damage?

Non-ILCFs Improperly Dismissed

Table 4-24: Average Mark II Conditional Offsite Consequences for the Different MELCOR Cases Associated with the CPRR Alternatives

	MELCOR Case	MACCS Bin	Individual Latent Cancer Fatality Risk (0-10 mi)	Population Dose (rem) (0-50 mi)	Offsite Cost ($ 2013) (0-50 mi)	Land Contamination (sq. miles) (0-50 mi)	Population Subject to Long-Term Protective Actions (0-50 mi)
Status Quo (No Water)	1	8	4.70E-04	6,110,000	85,500,000,000	854	721,000
	5	6	2.29E-04	2,160,000	24,000,000,000	303	62,400
	6	7	3.08E-04	4,140,000	80,800,000,000	698	619,000
	Average:		***3.40E-04***	***4,100,000***	***63,000,000,000***	***620***	***470,000***
SAWA	10	5	1.35E-04	689,000	4,250,000,000	130	15,400
	11	4	7.90E-05	202,000	844,000,000	44	1,030
	24	6	2.29E-04	2,160,000	24,000,000,000	303	62,400
	Average:		***1.50E-04***	***1,000,000***	***9,700,000,000***	***160***	***26,000***
SAWA + External Filter	10DF10	4	7.90E-05	202,000	844,000,000	44	1,030
	11DF10	3	6.58E-06	20,700	393,000,000	2	0
	24DF10	4	7.90E-05	202,000	844,000,000	44	1,030
	Average:		***5.50E-05***	***140,000***	***690,000,000***	***30***	***690***

With an external filter, Alternative 4 achieves only a modest reduction in ILCF but <u>huge</u> reductions in all other concurrent consequences.

Table 4-23: Average Mark I Conditional Offsite Consequences for the Different MELCOR Cases Associated with the CPRR Alternatives

	MELCOR Case	MACCS Bin	Individual Latent Cancer Fatality Risk (0-10 mi)	Population Dose (rem) (0-50 mi)	Offsite Cost ($ 2013) (0-50 mi)	Land Contamination (sq. miles) (0-50 mi)	Population Subject to Long-Term Protective Actions (0-50 mi)
Status Quo (No Water)	1	12	2.91E-04	1,720,000	13,000,000,000	549	64,500
	2	15	2.59E-04	1,740,000	15,700,000,000	573	111,000
	4	10	4.06E-04	1,360,000	9,900,000,000	479	51,400
	5	10	4.06E-04	1,360,000	9,900,000,000	479	51,400
	6	12	2.91E-04	1,720,000	13,000,000,000	549	64,500
	Average:		*3.30E-04*	*1,600,000*	*12,000,000,000*	*530*	*69,000*
SAWA/ SAWM	8	11	1.35E-04	1,110,000	5,960,000,000	286	40,500
	9	7	1.21E-04	524,000	2,740,000,000	190	15,000
	10	7	1.21E-04	524,000	2,740,000,000	190	15,000
	11	7	1.21E-04	524,000	2,740,000,000	190	15,000
	12	11	1.35E-04	1,110,000	5,960,000,000	286	40,500
	13	7	1.21E-04	524,000	2,740,000,000	190	15,000
	14	7	1.21E-04	524,000	2,740,000,000	190	15,000
	15	7	1.21E-04	524,000	2,740,000,000	190	15,000
	16	7	1.21E-04	524,000	2,740,000,000	190	15,000
	21	11	1.35E-04	1,110,000	5,960,000,000	286	40,500
	22	12	2.91E-04	1,720,000	13,000,000,000	549	64,500
	23	11	1.35E-04	1,110,000	5,960,000,000	286	40,500
	25	7	1.21E-04	524,000	2,740,000,000	190	15,000
	26	7	1.21E-04	524,000	2,740,000,000	190	15,000
	28	7	1.21E-04	524,000	2,740,000,000	190	15,000
	29	6	7.95E-05	253,000	1,150,000,000	116	3,440
	30	7	1.21E-04	524,000	2,740,000,000	190	15,000
	Average:		*1.30E-04*	*720,000*	*4,000,000,000*	*230*	*23,000*
SAWA/ SAWM + External Filter	8DF10	6	7.95E-05	253,000	1,150,000,000	116	3,440
	9DF10	5	2.03E-05	71,200	220,000,000	41	118
	10DF10	5	2.03E-05	71,200	220,000,000	41	118
	11DF10	5	2.03E-05	71,200	220,000,000	41	118
	12DF10	6	7.95E-05	253,000	1,150,000,000	116	3,440
	13DF10	5	2.03E-05	71,200	220,000,000	41	118
	14DF10	5	2.03E-05	71,200	220,000,000	41	118
	15DF10	5	2.03E-05	71,200	220,000,000	41	118
	16DF10	5	2.03E-05	71,200	220,000,000	41	118
	21DF10	6	7.95E-05	253,000	1,150,000,000	116	3,440
	22DF10	6	7.95E-05	253,000	1,150,000,000	116	3,440
	23DF10	6	7.95E-05	253,000	1,150,000,000	116	3,440
	25DF10	5	2.03E-05	71,200	220,000,000	41	118
	26DF10	5	2.03E-05	71,200	220,000,000	41	118
	28DF10	5	2.03E-05	71,200	220,000,000	41	118
	29DF10	4	1.72E-05	48,400	141,000,000	23	7
	30DF10	5	2.03E-05	71,200	220,000,000	41	118
	Average:		*3.80E-05*	*120,000*	*490,000,000*	*62*	*1,100*

With an external filter, Alternative 4 achieves only a modest reduction in ILCF but huge reductions in all other concurrent consequences.

damages (5 trillion yen). This compensation is mainly given to 86,000 individuals that have been displaced from areas of the government mandated evacuation and affected businesses.[43]

In comparison to a cost of about $76 billion for an accident affecting 86,000 individuals, Mark I source term bin 14, represented by case 22dw, subjects 93,700 individuals to long-term protective actions for the area within 50 miles. This case has a total offsite economic cost of about $12.9 billion associated with the 50-mile area. Comparing the two costs for accidents that displace a roughly similar population size shows that the Government of Japan projects the cost to be roughly 6 times higher than the MACCS calculation in this analysis. The reason for this difference is not well understood yet, as the estimates are based on a number of factors such as the length of time before people return and the level of necessary cleanup efforts. As more

The Regulatory Analysis of post-Fukushima upgrades acknowledges that actual costs from Fukushima are only about 6 times higher than the post-accident costs it calculated for reasons that are "not well understood yet."

When in doubt, throw it out?

Alternative 5: More Reliable MBDBE?

Why not severe-accident-capable reliable reactor pressure vessel relief capability?

Why not FLEX pumps that can inject into the reactor pressure vessel up to the SRV pressure?

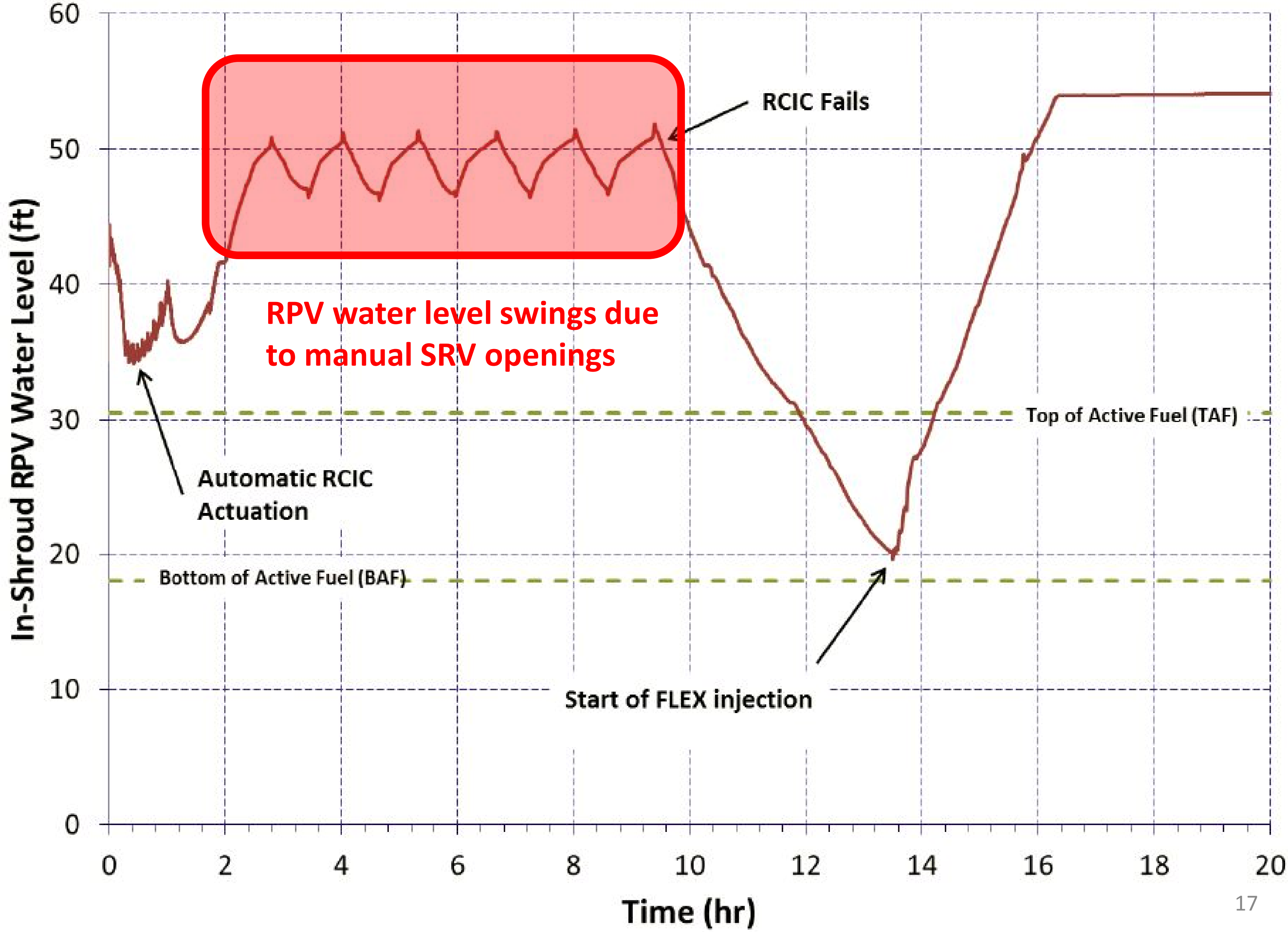
Why not severe-accident-capable reliable instrumentation?

Reliable RPV Relief Valves

- The plant operators will reduce RPV pressure using the safety relief valves (SRVs) to a range of 200-400 psig in order to minimize SRV cycling and to minimize heatup of the suppression pool.
- The CDETs credit local manual operation of SRVs if dc power fails.

But the SRVs require more than dc power in order to be manually opened.

Figure 4-20: Mark I RPV Water Level for Case 9-IVR



Reliable RPV Relief Valves

The ADS uses selected SRVs for depressurization of the reactor, as described in Section 6.3. Each of the SRVs used for automatic depressurization is equipped with an air accumulator and check valve arrangement. These accumulators ensure that the valves can be held open following failure of the air supply to the accumulators. They are sized to be capable of opening the valves and holding them open against the maximum drywell pressure of 62 psig. The accumulator capacity is sufficient for each ADS valve to provide two actuations against 70 percent of the maximum drywell design pressure.

5.2-15

HCGS-UFSAR

Revision 0
April 11, 1988

Source: Hope Creek Generating Station Updated Final Safety Analysis Report

SRVs need dc power and pneumatic pressure to open. Why not require severe-accident-capable reliable RPV relief valves?

High Pressure FLEX RPV Injection

- If the RCIC pump fails, core cooling can be provided by aligning the portable FLEX pump for RPV injection and depressurizing the RPV below the portable FLEX pump's shutoff head.

FLEX seems inflexible by needing the RPV pressure to be low enough for it to inject water. Why not procure portable FLEX pumps flexible enough to inject water to the RPV all the way up to the SRV pressure?

Reliable Instrumentation

Operator actions to prevent or mitigate severe accidents are contingent on the availability and functionality of equipment and diagnostic instruments under severe accident conditions. The MELCOR analysis provides insights on the timeline for such actions. The SRM to SECY-12-0157 mentions consideration of equipment availability as one of several performance measures. The impacts of equipment availability can be quantitatively measured by the conditional uncontrolled release index (CURI) which is reviewed in Section 5, "Performance Criteria Information". The operator relies on instruments to know when to add water and/or to take other accident management actions. Therefore, instrument availability and reliability play an important role in this respect. In the PRA done as part of this evaluation, FLEX was assumed to be 60 percent successful. In the accident progression analysis using MELCOR, instruments measuring the RPV and containment water levels and pressures were assumed to be available. Note that 10 CFR 50.34(f)(2)(xix) requires licensees to provide instrumentation adequate for monitoring plant conditions following an accident that includes core damage.

- Information on some parameters may not be available to the operators or may be ambiguous for decisionmaking.

Successful mitigation depends on reliable diagnoses. Why not identify key parameters that must be monitored for the EOPs, EPGs, and SAMGs and require severe-accident-capable reliable instrumentation?

GE Mark I and Mark II Containment Protection & Release Reduction:

A Fukushima Lesson Unlearned In U.S.

NRC ACRS Full Committee
September 9, 2015

Paul Gunter
Beyond Nuclear

Some context to Commission "About-Face"

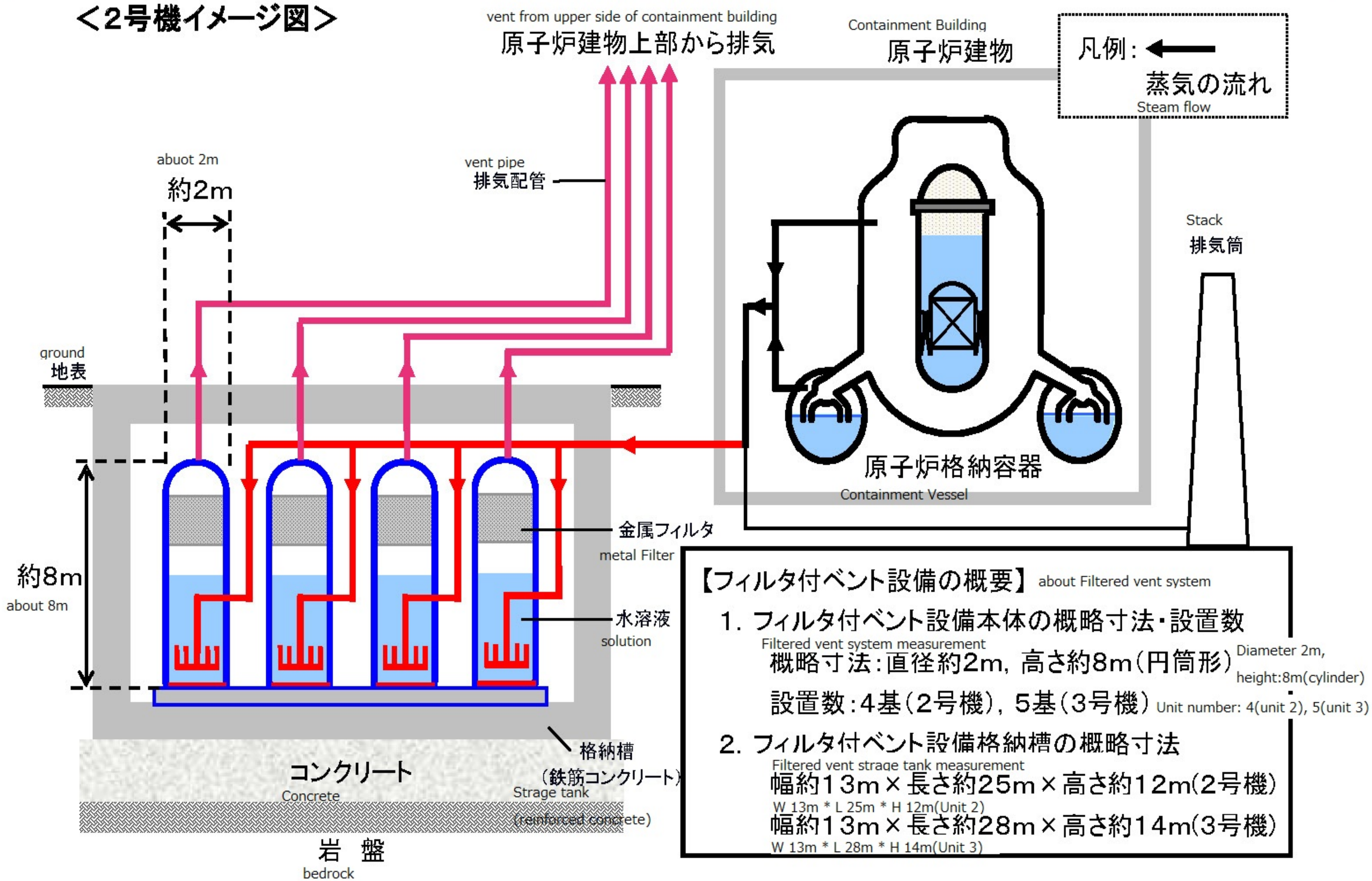
August 17, 2015
AREVA delivers Filtered Containment Venting System to Hamaoka for its 14th installation at Japanese nuclear power stations

August 18, 2015
As per NRC plan, ACRS subcommittee meets and agrees to draft letter to Commission on Containment Protection and Release Reduction (CPRR) proposed rulemaking

August 19, 2015
- **Commission Notation Vote (3-1) adopts "Status Quo"**
- **Abandons CPRR proposed rulemaking activity**
- **Abruptly closes out independent expert analyses and public comments on severe accident management for controversial U.S. Mark I and Mark II containment systems including external filtration in vent lines**

添付資料

フィルタ付ベント設備の概要



【フィルタ付ベント設備の概要】 about Filtered vent system

1. フィルタ付ベント設備本体の概略寸法・設置数

Filtered vent system measurement

概略寸法：直径約2m，高さ約8m（円筒形） Diameter 2m, height:8m(cylinder)

設置数：4基（2号機），5基（3号機） Unit number: 4(unit 2), 5(unit 3)

2. フィルタ付ベント設備格納槽の概略寸法

Filtered vent strage tank measurement

幅約13m×長さ約25m×高さ約12m（2号機）

W 13m * L 25m * H 12m(Unit 2)

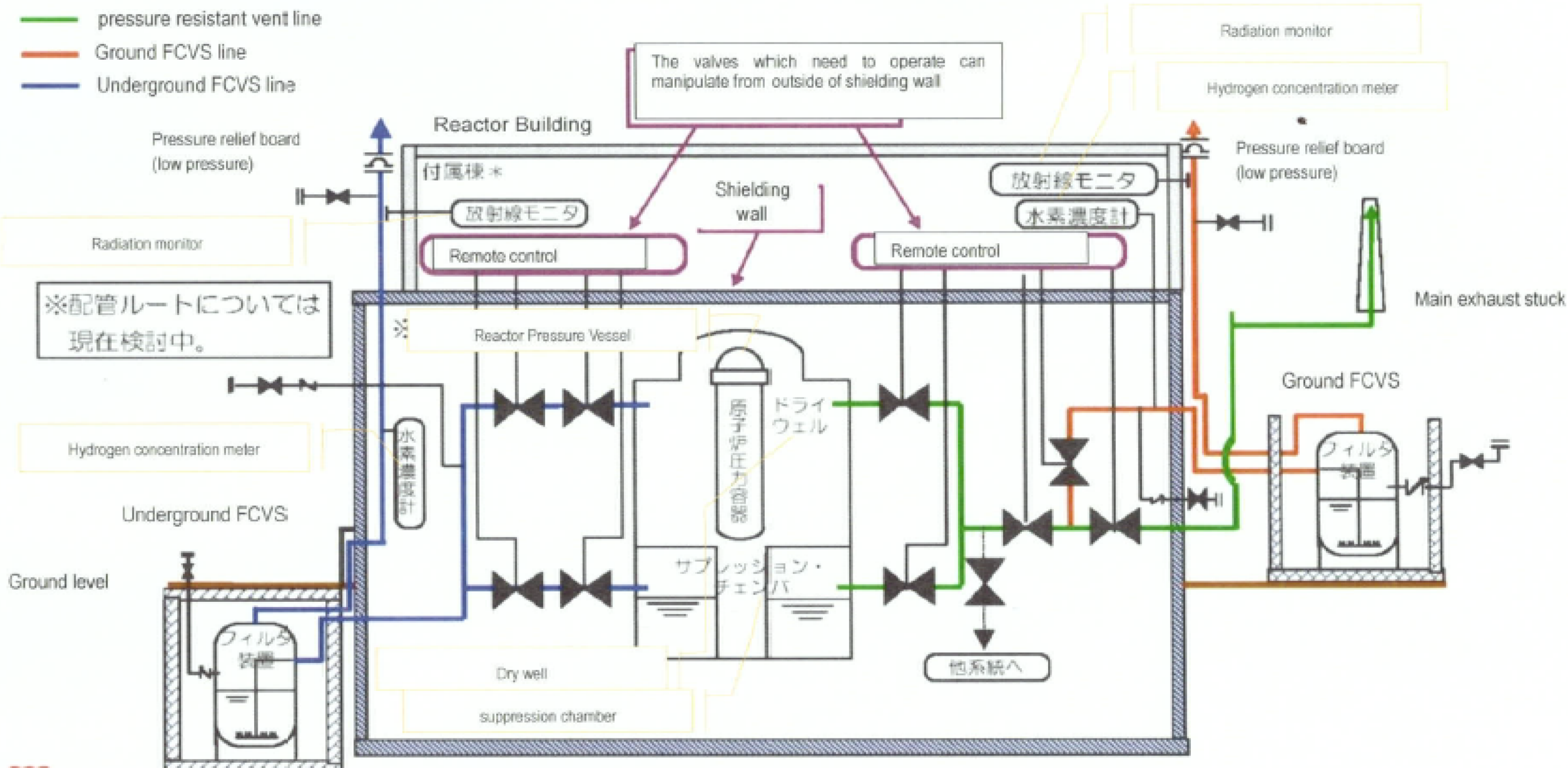
幅約13m×長さ約28m×高さ約14m（3号機）

W 13m * L 28m * H 14m(Unit 3)

Overview of ground and underground filter vent equipment

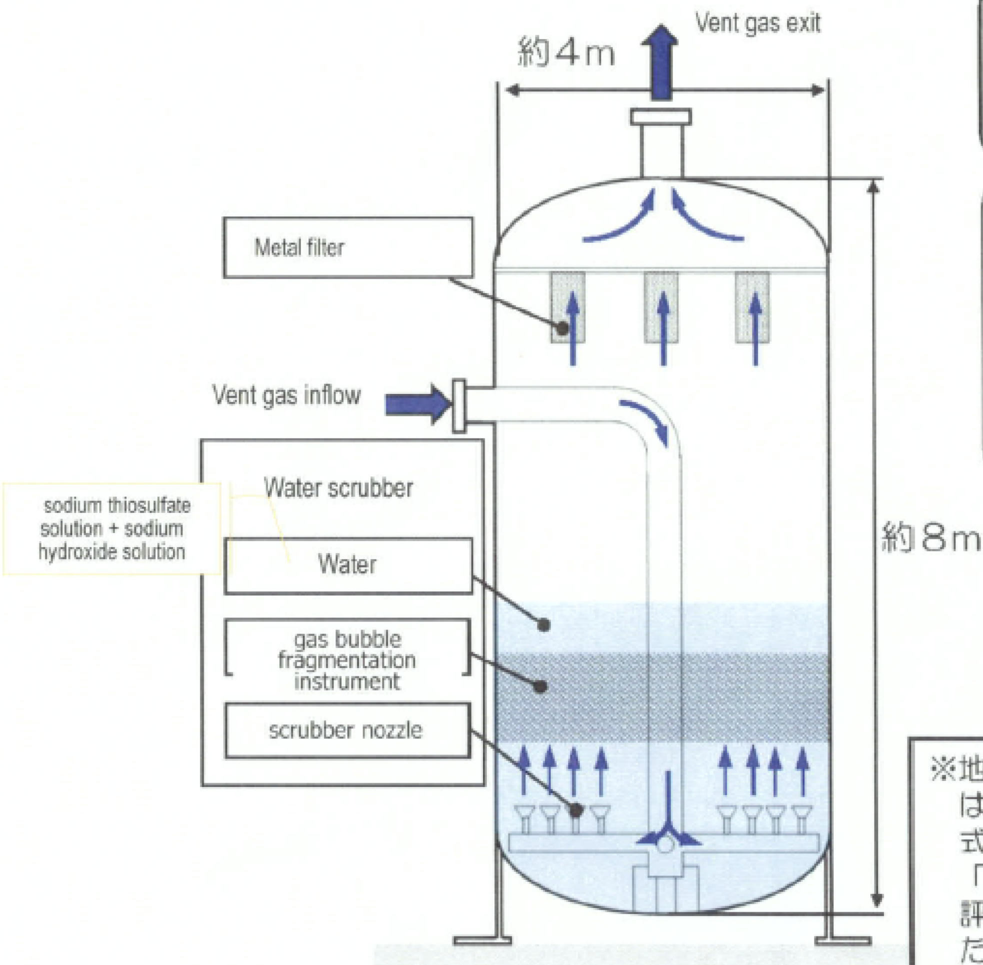
地上式及び地下式フィルタベント装置の概要について

- Ground FCVS lead vent line from pressure resistant vent line (underground FCVS leads directly from containment vessel), then decrease radioactive material then vent it from the roof of reactor building.
- The valves which need to operate can manipulate from outside of shielding wall during accident.
- Do not share the line with other equipment for sure to lead the gas to filter.



filter vent equipment structure

フィルタ装置の構造



Metal filter

Metal filter gathers radioactive particle when gas pass through metal filter.

Water Scrubber

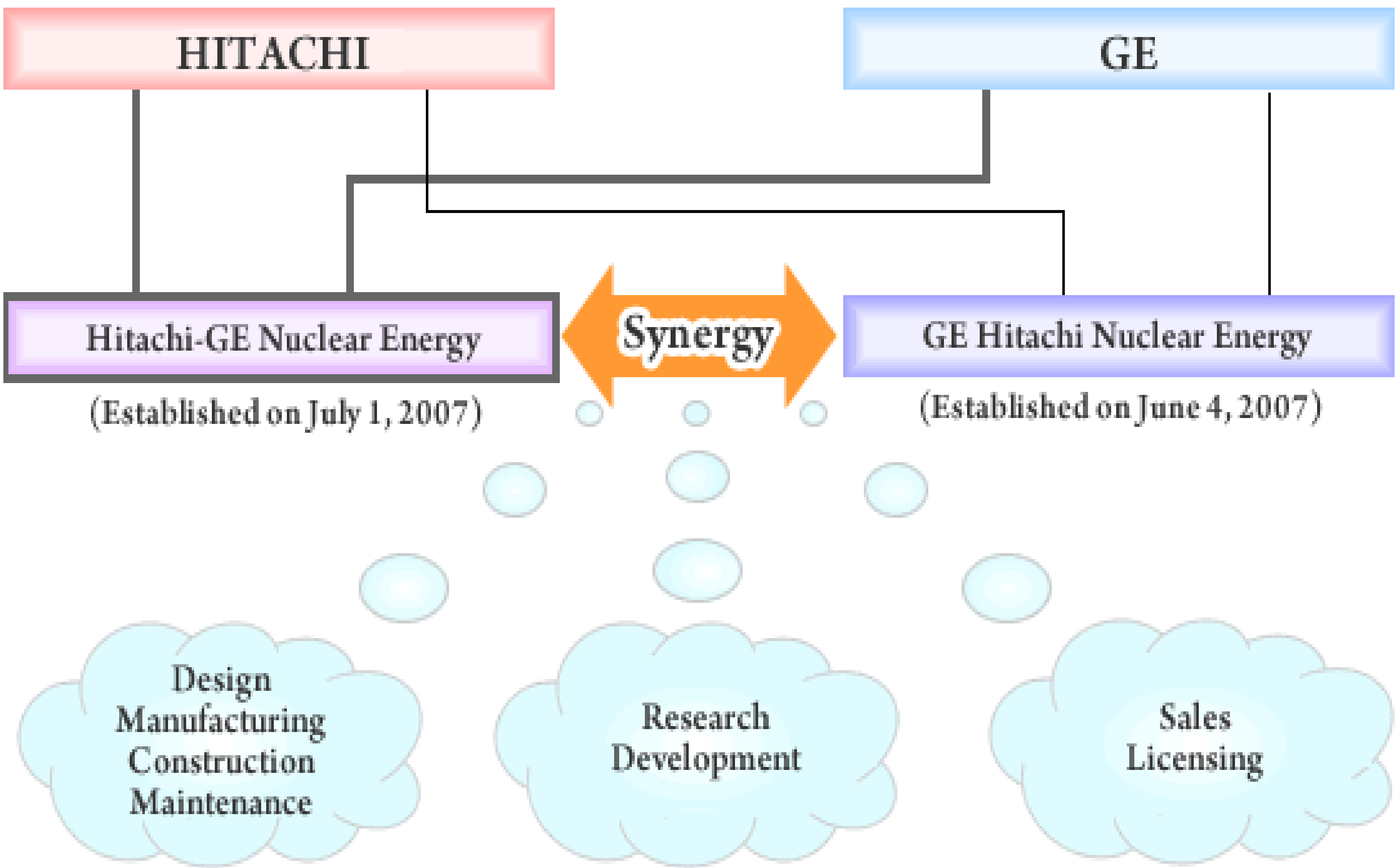
Water gathers radioactive particle when gas pass through metal filter.

To collect radioactive particle effectively, blow off the gas fast and furiously by scrubber nozzle, and break up bubbles by gas bubble fragmentation instrument

Extraction rate higher than 99.9%
Radioactive particle (Radioactive Cesium)

※地上式フィルタベントと地下式フィルタベントの性能は同等であり,地上式フィルタベント設備もしくは地下式フィルタベント設備のいずれかで原子力規制庁の「炉心損傷防止及び格納容器破損防止対策の有効性の評価に係る標準評価手法（審査ガイド）」の要求を満たす設計とする。

DISCONNECT OR DUAL STRATEGY IN BOILING WATER REACTOR OWNERS GROUP RISK-BENEFIT COMMUNICATIONS?



PUBLIC PROTECTION REQUIRES FILTERS

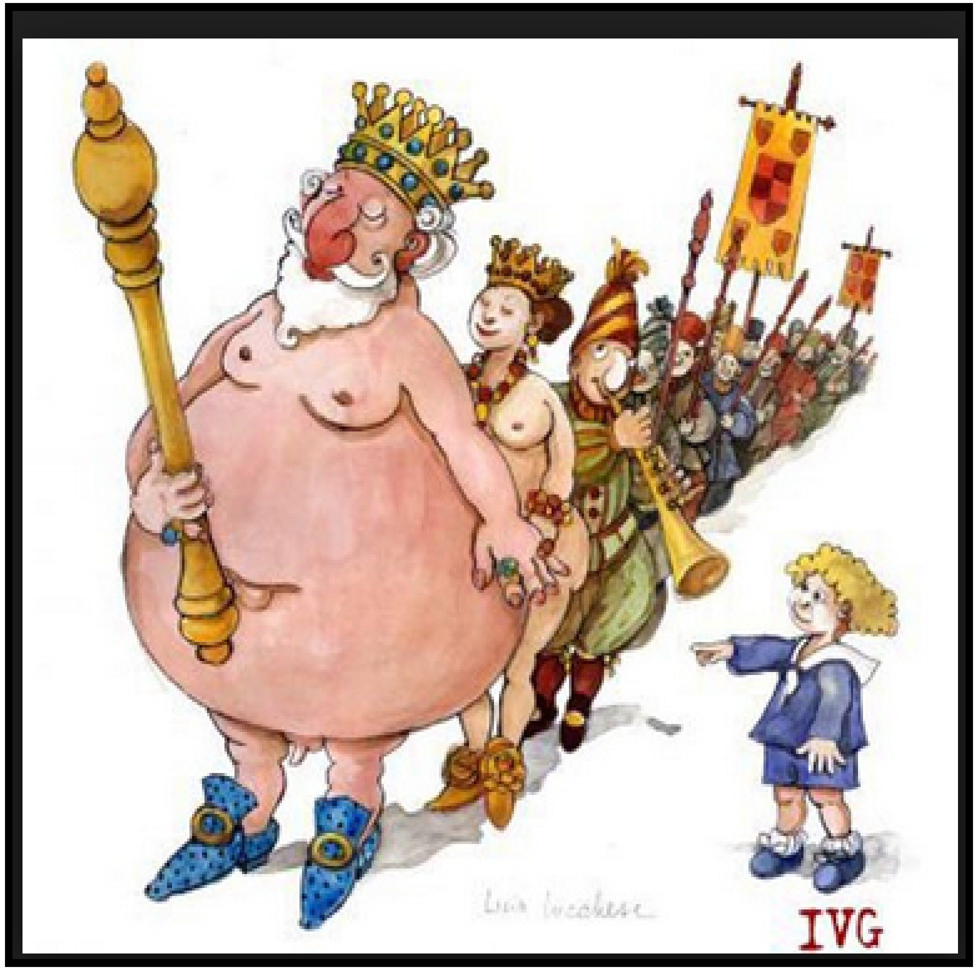
Mary Lampert, Pilgrim Watch

ACRS Presentation

September 9, 2015

Good Afternoon

Staff Analysis Does Not Recommend Filters
What's Wrong?



An “Inconvenient Truth”

A $11- $64 million filter saves

$ 3.51 billion in Economic Consequences

Table 4-23: Average Mark I Conditional Offsite Consequences for the Different MELCOR Cases Associated with the CPRR Alternatives

	MELCOR Case	MACCS Bin	Individual Latent Cancer Fatality Risk (0-10 mi)	Population Dose (rem) (0-50 mi)	Offsite Cost ($ 2013) (0-50 mi)	Land Contamination (sq. miles) (0-50 mi)	Population Subject to Long-Term Protective Actions (0-50 mi)
Status Quo (No Water)	1	12	2.91E-04	1,720,000	13,000,000,000	549	64,500
	2	15	2.59E-04	1,740,000	15,700,000,000	573	111,000
	4	10	4.06E-04	1,360,000	9,900,000,000	479	51,400
	5	10	4.06E-04	1,360,000	9,900,000,000	479	51,400
	6	12	2.91E-04	1,720,000	13,000,000,000	549	64,500
	Average:		***3.30E-04***	***1,600,000***	***12,000,000,000***	***530***	***69,000***
SAWA/ SAWM	8	11	1.35E-04	1,110,000	5,960,000,000	286	40,500
	9	7	1.21E-04	524,000	2,740,000,000	190	15,000
	10	7	1.21E-04	524,000	2,740,000,000	190	15,000
	11	7	1.21E-04	524,000	2,740,000,000	190	15,000
	12	11	1.35E-04	1,110,000	5,960,000,000	286	40,500
	13	7	1.21E-04	524,000	2,740,000,000	190	15,000
	14	7	1.21E-04	524,000	2,740,000,000	190	15,000
	15	7	1.21E-04	524,000	2,740,000,000	190	15,000
	16	7	1.21E-04	524,000	2,740,000,000	190	15,000
	21	11	1.35E-04	1,110,000	5,960,000,000	286	40,500
	22	12	2.91E-04	1,720,000	13,000,000,000	549	64,500
	23	11	1.35E-04	1,110,000	5,960,000,000	286	40,500
	25	7	1.21E-04	524,000	2,740,000,000	190	15,000
	26	7	1.21E-04	524,000	2,740,000,000	190	15,000
	28	7	1.21E-04	524,000	2,740,000,000	190	15,000
	29	6	7.95E-05	253,000	1,150,000,000	116	3,440
	30	7	1.21E-04	524,000	2,740,000,000	190	15,000
	Average:		***1.30E-04***	***720,000***	***4,000,000,000***	***230***	***23,000***
SAWA/ SAWM + External Filter	8DF10	6	7.95E-05	253,000	1,150,000,000	116	3,440
	9DF10	5	2.03E-05	71,200	220,000,000	41	118
	10DF10	5	2.03E-05	71,200	220,000,000	41	118
	11DF10	5	2.03E-05	71,200	220,000,000	41	118
	12DF10	6	7.95E-05	253,000	1,150,000,000	116	3,440
	13DF10	5	2.03E-05	71,200	220,000,000	41	118
	14DF10	5	2.03E-05	71,200	220,000,000	41	118
	15DF10	5	2.03E-05	71,200	220,000,000	41	118
	16DF10	5	2.03E-05	71,200	220,000,000	41	118
	21DF10	6	7.95E-05	253,000	1,150,000,000	116	3,440
	22DF10	6	7.95E-05	253,000	1,150,000,000	116	3,440
	23DF10	6	7.95E-05	253,000	1,150,000,000	116	3,440
	25DF10	5	2.03E-05	71,200	220,000,000	41	118
	26DF10	5	2.03E-05	71,200	220,000,000	41	118
	28DF10	5	2.03E-05	71,200	220,000,000	41	118
	29DF10	4	1.72E-05	48,400	141,000,000	23	7
	30DF10	5	2.03E-05	71,200	220,000,000	41	118
	Average:		***3.80E-05***	***120,000***	***490,000,000***	***62***	***1,100***

An Honest Analysis

Health Costs Justify a Filter

<u>NRC's "Solution" to that "Inconvenient Truth"</u>

- Assume evacuations take < 6 hours
- Assume SAWA/SAWM will delay releases to allow timely evacuations
  - Staff ignores its admission that SAWA does not work 40% of the time.
- Improperly limiting health impacts to cancer fatalities & to a too small geographic area

Evacuations take more than 6 hours
Especially in nuclear disasters

NUREG/CR-7002 Guidance & ETE's Underestimate Evacuation Times

Incorrect Assumptions - How many will evacuate

<u>Examples:</u>

- NRC telephone surveys do not explain survey is for nuclear disaster and elicit false information – Cape Survey (70%) v. Sandia (20%)
- Staged evacuation not supported – Cape Survey
- Shadow evacuation > 20% and extends to at least 25 miles, not 5 miles – Cape Survey
- Siren messages not heard by 70% - Town of Duxbury Survey

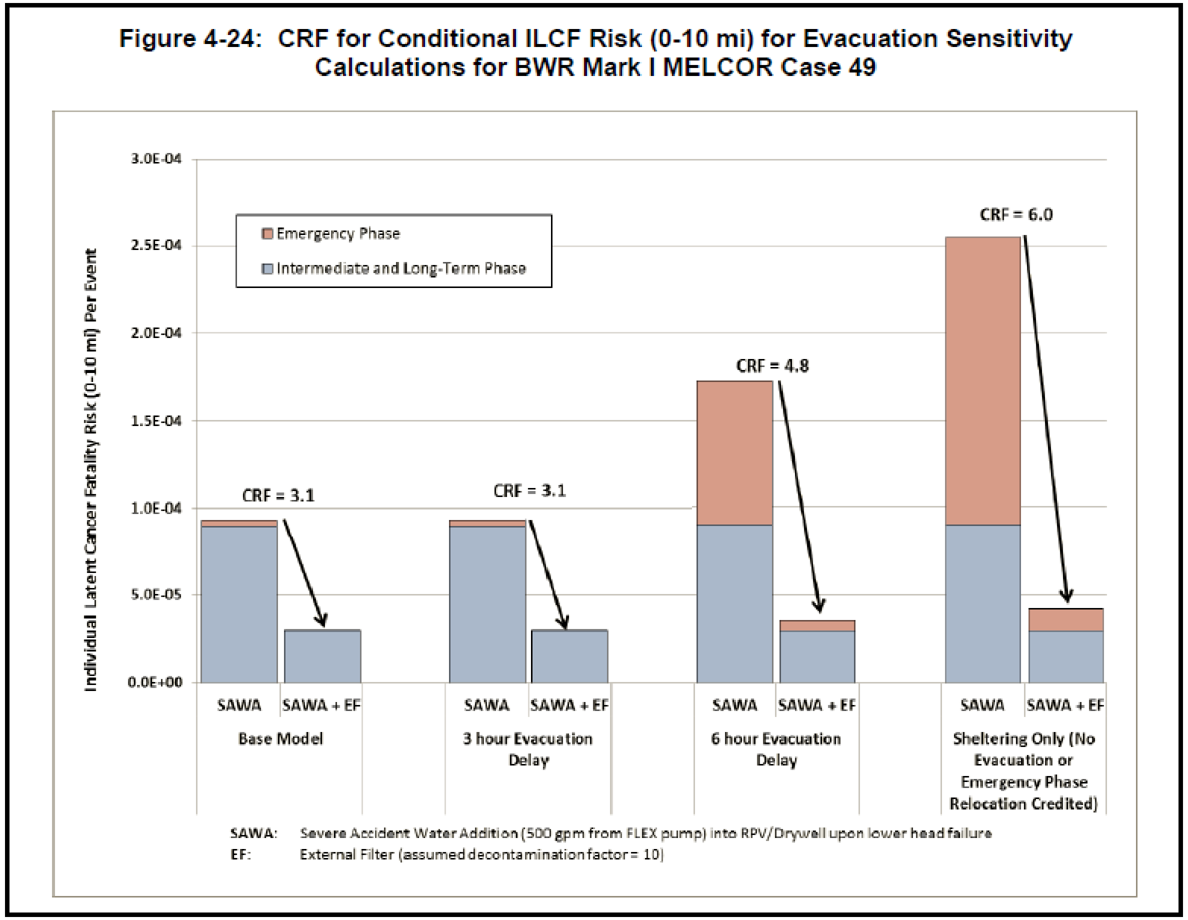
Cape Cod Telephone Survey
Told Respondents to Assume a Nuclear Accident

- 70% (not 20%) would evacuate
- 50% would evacuate even if told they were not in the EPZ
- The Cape Cod respondents lived 10-25 miles from Pilgrim; their “shadow evacuation” was not limited to those within 15 miles as assumed by NRC

<u>Bottom Line:</u>

- The number within the EPZ that will evacuate is three (3) times the NRC assumption
- 50% “Shadow evacuation" outside the EPZ is 2 ½ times NRC assumption
- 250% to 300% increase in number of evacuees →huge increase in traffic density and decrease in speed → dramatic increase in ETE

NRC's Draft Figure 4-24
Clear Health Benefit From Adding Filters

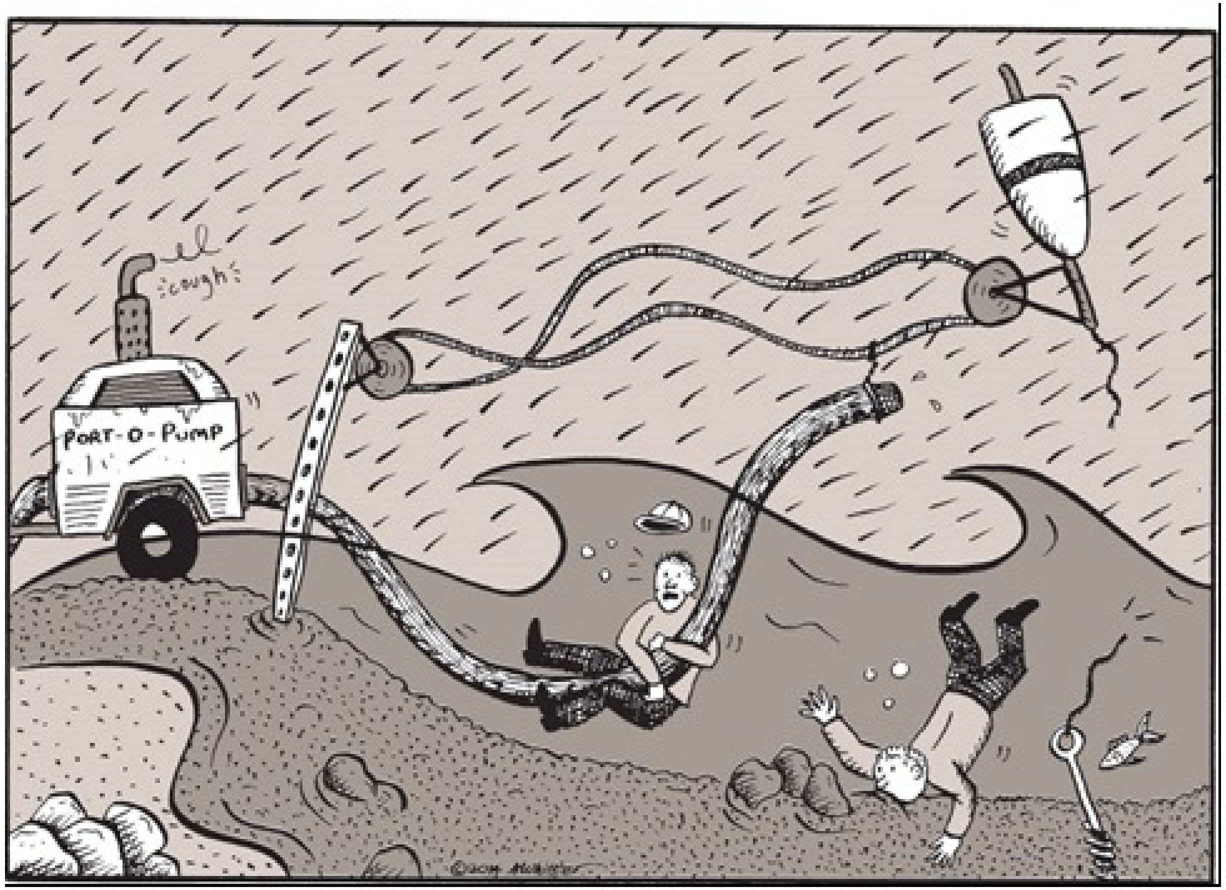


Staff Assumption of Health Costs
Another Ludicrous Assumption

Staff assumed that accidents will be slow breaking allowing timely evacuations

- This depends on SAWA working. Staff assumed this would be the case only 60% of the time.
- Staff ignored accidents that cannot be assumed to be slow breaking - the 40% of the time that Staff said SAWA will not work.
- Any "solution" that purports to insure public health and safety even 60% of the time is wrong.

SAWA/SAWM - No Basis to Assume Works 6 out of 10 times – Pilgrim's Plan

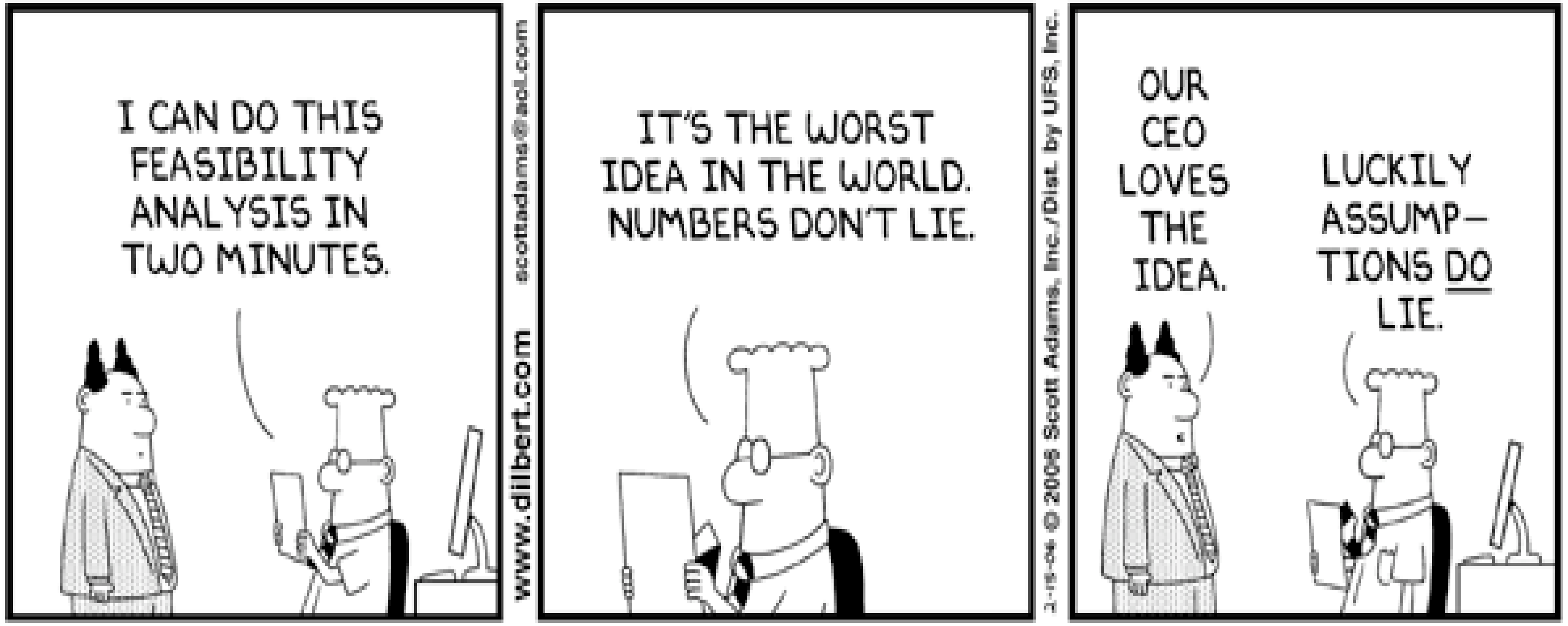


Health Impact Underestimated

Staff limited Radiation Health Impacts to Cancer Fatalities

- Ignored cancer incidence, birth defects, reproductive disorders, other health impacts discussed in BEIR VII
- Ignored likely geographic impact

Staff Draft based Faulty Cost-benefit Analysis & Use Outdated Computer Tools - MELCOR/MACCS/SOARCA



What's Wrong with Staff PRA Analysis

1. PRA multiplies "probability" and "consequences."
2. Staff Underestimated Probability
   - Assumed SAWA works
   - MACCS assumes (1) core damage event every 31,000 reactor years.
   - History shows (5) actual core damages in 36 years - 1 every 7 yrs.
3. Staff Underestimated Consequences
   - Considered only gamma (Iodine) and a small faction of Cs-137
   - Realistic ETE's result in much greater consequences
   - NRC says a life is worth $3 million; other agencies say $5-9 million

What's Wrong with Staff PRA Analysis (cont'd)

4. Unrealistically limited radioactive release concentration and geographic area impacted by using simplistic straight-line Gaussian plume model

5. Underestimated economic costs although Staff analysis justified filters.

- Underestimated size of contaminated area and extent of contamination
- Underestimated volume of contaminated waste
- Ignored forests, wetlands, and bodies of water that cannot be decontaminated
- Ignored that technologies needed for cleanup have not been developed
- Ignored that there is no cleanup standard - Reichmuth & Luna
- Ignored that there are no locations to bring large volumes of waste

OIG Audit of NRC's Regulatory Analysis Process (OIG-15-A-15 June 24, 2015)

OIG found that NRC Staff has limited cost-estimating experience making it "vulnerable to errors and flawed decision-making."

- This analysis is a good example
- The Staff's flawed cost-benefit analysis got the right answer for industry; but the wrong answer for public health and safety

Byron

Byron Station, Units 1 and 2

Braidwood

Braidwood Station, Units 1 and 2

License Renewal Application

ACRS Full Committee Presentation

September 10, 2015

Exelon.

Introductions

• Mike Gallagher	VP, Exelon License Renewal
• John Bashor	Braidwood Engineering Director
• Albert Piha	LR Manager, Byron and Braidwood
• John Hufnagel	Project Licensing Engineer

Agenda

• Introductions	Mike Gallagher
• Station Descriptions and Overview	John Bashor
• GALL Consistency and Commitments	Albert Piha
• Resolution of Open Items	Albert Piha
– EAF Screening Methodology	
– CRDM Housing Wear	
• Items of Interest from Region III Inspections	John Bashor
– Visual Examination of Concrete Containment	
– CRDM Seismic Support Assembly	
– Flux Thimble	
• Closing Remarks	Mike Gallagher

Byron and Braidwood Station Locations

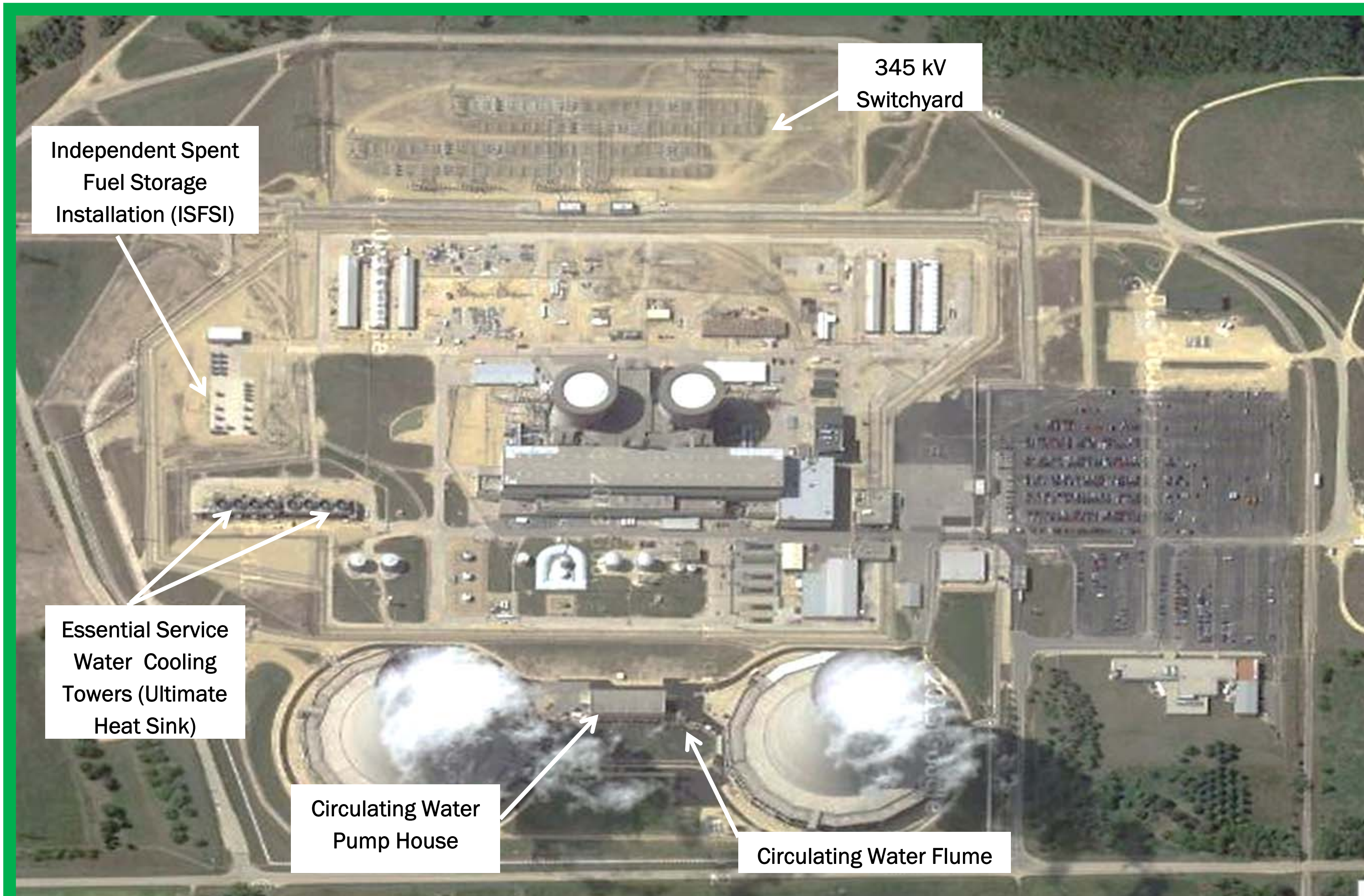
Byron

Byron Station, Units 1 and 2

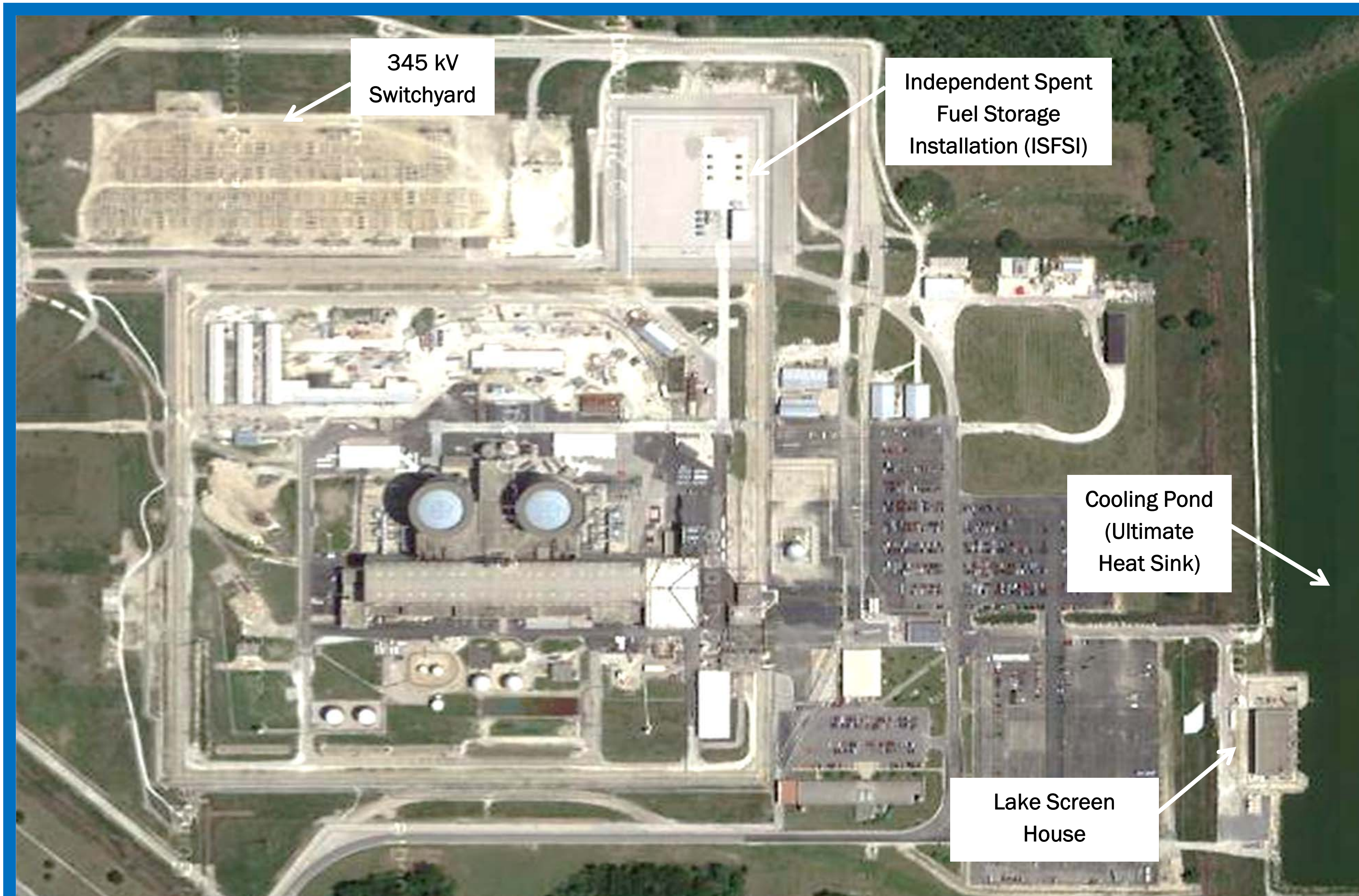
Braidwood

Braidwood Station, Units 1 and 2

Byron Station



Braidwood Station



Station Overview

	Byron		Braidwood	
	Unit 1	Unit 2	Unit 1	Unit 2
Initial License Date	10/31/84	11/06/86	10/17/86	12/18/87
5% Power Uprate to 3586.6 MW_t	2001	2001	2001	2001
1.63% Measurement Uncertainty Recapture (MUR) 3645 MW_t	2014	2014	2014	2014
Steam Generator Replacement	1998	-	1998	-
ECCS Recirculation Sump Screens	2006	2007	2007	2006
Spent Fuel Rack Replacements	2000		2001	
Independent Spent Fuel Storage Installation (ISFSI)	2009		2011	
Current License Expiration Date	10/31/24	11/06/26	10/17/26	12/18/27

GALL Revision 2 Consistency
and
License Renewal Commitments

Byron Station, Units 1 and 2

Braidwood Station, Units 1 and 2

Exelon.

GALL Consistency and Commitments

- Submittal based on GALL, Revision 2
- License Renewal Commitments
  - UFSAR Supplement (Appendix A of the LRA)
  - Managed by Exelon Commitment Tracking program based on Nuclear Energy Institute 99-04, "Guidelines for Managing NRC Commitment Changes"

	Byron	Braidwood
Total AMPs	45	44
AMPs Consistent with GALL	37	35
AMPs with Exception to GALL	8	9
Commitments	47	46

Exelon

Resolution of Open Items

Byron Station, Units 1 and 2

Braidwood Station, Units 1 and 2

Resolution of Open Items

- OI 4.3-1: Environmentally Assisted Fatigue (EAF)
  - ✓ Provided information on leading component screening methodology and added locations to the list of leading equipment locations that will be monitored for the pressurizers and steam generators
- OI 3.0.3.1.3-1: CRDM Nozzle Wear
  - ✓ PWROG analysis concluded CRDM housings are acceptable with maximum wear
  - ✓ Exelon committed to perform UT examinations of the five centermost CRDM housings during the ten-year period prior to the PEO, and every ten years in the PEO

Resolution of Region III Inspection Items of Interest

Byron Station, Units 1 and 2

Braidwood Station, Units 1 and 2

Resolution of Region III Inspection Items of Interest

- Visual Examination of Concrete Containment Structures
  - ✓ Added commitment to require visual resolution capability for direct and remote examinations to be sufficient to detect concrete degradation at the levels described in Chapter 5 of ACI 349.3R

- CRDM Seismic Support Assembly (CRDM SSA) Aging Management
  - ✓ Added CRDM SSA to scope of IWF program for license renewal aging management

Resolution of Region III Inspection Items of Interest

- Braidwood Flux Thimble Eddy Current Testing Program
  - ✓ Added commitment to resolve the recent difficulty in obtaining ECT data prior to PEO
  - ✓ Added commitment to replace a flux thimble tube every 2 refueling outages if required ECT data is not obtained for that tube
  - ✓ ECT data for all 58 Braidwood Unit 1 flux thimbles was obtained during recent Spring 2015 refueling outage

Closing Remarks

U.S.NRC

United States Nuclear Regulatory Commission

Protecting People and the Environment

Advisory Committee on Reactor Safeguards Full Committee Meeting

Safety Evaluation Report Regarding Byron Station, Units 1 and 2, and Braidwood Station, Units 1 and 2

September 10, 2015

John Daily, Sr. Project Manager
Office of Nuclear Reactor Regulation

Outline

- Recent completed Milestones
- Closure of Open Items
  – CRDM Nozzle Wear
  – Environmentally Assisted Fatigue in Class 1 Components
- Updates
  – Status of Byron 2 stuck closure stud
  – Issues arising from the 71002 Inspection
- Staff Conclusion for the Safety Evaluation

Completed Milestones

- Safety Evaluation Report (SER) with Open Items issued October 30, 2014
- ACRS License Renewal Subcommittee Meeting held December 3, 2014
- All Open Items (OIs) for the SER are closed
- All 71002 Issues for the SER are resolved
- Final SER issued July 6, 2015

Open Item Closure

OI 3.0.3.1.3-1 CRDM Nozzle Wear:

- **Issue**: CRDM nozzle wear not adequately managed during PEO.
- **Basis for closure**: Applicant enhanced its ASME Section XI Inservice Inspection program to manage the CRDM penetration nozzle wear by volumetric examinations.

Open Item Closure

OI 4.3-1 Environmentally Assisted Fatigue in Class 1 Components:

- **Issue**: Insufficient justification for selecting leading locations
  - How one material bounds other materials
  - Basis for comparison of CUF_{en} values (screening out the higher CUF_{en} value)
- **Basis for closure**: Applicant Actions
  - Added the limiting locations of all materials back in to the list of monitored components
  - Refined stress basis analyses and showed that the chosen component is indeed the bounding location

Closure Stud Update

Reactor vessel head closure stud – Byron 2

- **Issue:** Closure stud #11 became stuck (2010), insufficient threads for tensioning
  - Top 5 in. cut off for clearance
- **Basis for Closure**: Applicant repaired stud #11
  - Commitment #47 completed

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Protecting People and the Environment

Closure Stud Update

Reactor vessel head closure stud – Braidwood 2

- **Issue:** Closure stud #35 became stuck (1991), RV stud hole damaged (2002)
  - Closure stud currently removed
- **Basis for closure**: Applicant committed to repair location and restore to fully operable
  - Staff will elevate this commitment (No. 48) to a license condition requiring restoration to operability prior to PEO

Issues from 71002 Inspection

- CRDM seismic support assembly bolting (IWF)
- Visual examinations – containment concrete (IWL)
- Flux thimble tube inspections – Braidwood 1&2
  - Includes proposed license condition

Issue 1 from 71002 Inspection

CRDM seismic support assembly bolting (IWF)

- **<u>Issue</u>:** LRA revision included CRDM Seismic Support Assemblies, but did not specify whether the assemblies include high-strength bolting greater than 1” diameter
- **<u>Basis for resolution</u>**: Aging management of high-strength bolting
  - CRDM seismic supports do not have high-strength bolting greater than 1” diameter
  - This issue is resolved

Issue 2 from 71002 Inspection

Visual examinations of containment concrete (IWL)

- **<u>Issue</u>:** Visual inspections of some areas of concrete conducted remotely using an optical aid, yet may not allow adequate visual resolution ability

- **<u>Basis for resolution</u>**: Enhancement to ensure adequate visual resolution capability of optical aids to detect and quantify relevant findings against quantitative acceptance criteria.

Issue 3 from 71002 Inspection

Flux Thimble Tube Inspection AMP

- AMP for Braidwood was initially found acceptable
- Staff reviewed LRA and OE
- Staff issued RAI
- Staff closed evaluation based on RAI response
- 71002 inspection identified new concerns

Issue 3 from 71002 Inspection

Additional concerns from the 71002 Inspection

- AMP might not be adequate
- Continuing problems with tube examinations at Braidwood since 2012
- Efforts to correct the problems did not appear to be effective
- Indications that problems might be occurring at increasing rate

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Protecting People and the Environment

Issue 3 from 71002 Inspection

Basis for resolution

Applicant enhancement and commitment (No. 24):

- Tubes with wear replaced, removed from service unless successful eddy current testing obtained
- Inspect all tubes every refueling outage until data collected/plant-specific test frequency established
- Replace any tube after 2 cycles if data not obtained

Staff resolution:

- Elevate commitment to license condition with 1 change
- Retain statements to replace/remove/successfully test
- Inspect all tubes at least every 2 refueling outages
- No tube to remain in service more than 2 cycles without successful data obtained

Conclusion

On the basis of its review, the staff determines that the requirements of 10 CFR 54.29(a) have been met for the license renewal of Byron Station, Units 1 and 2, and Braidwood Station, Units 1 and 2.

Industry Comments on DC/COL-ISG-028

Assessing the Technical Adequacy of the Advanced Light-Water Reactor Probabilistic Risk Assessment for the Design Certification Application and Combined License Application

Victoria Anderson, NEI

ACRS Meeting

September 10, 2015

Background

- Draft ISG issued for comment in late 2014
  - Provides staff position on applicability of existing ASME/ANS PRA Standard to DC and COL plants
  - To be used for evaluation of technical adequacy of PRAs for new build plants one year prior to fuel load
- NEI provided comments on January 23, 2015
  - Focused on appropriateness of various supporting requirements for DC and COL applicants
  - Industry has not yet seen most recent draft of ISG

Capability Category Treatment

- Focus of DC/COL-ISG-028 is on Capability Category (CC) I
  - Consistent with DC/COL-ISG-003, *PRA Information to Support Design Certification and Combined License Applications*
  - Section 4.c.: PRAs that meet the applicable supporting requirements for Capability Category I and meet the high level requirements as defined in the ASME PRA Standard (ASME-RA-Sb-2005) should generally be acceptable for DC and COL applications.
- Some Supporting Requirements (SRs) state "no action" to meet CC I
  - DC/COL-ISG-028 gives expectation to meet Capability Category II in some of these cases
  - Potentially contrary to DC/COL-ISG-003

Potential for Improved Clarity

- DC/COL-ISG-028 unclear on “cannot meet” vs. “can meet” for use of generic and plant specific data
- References to using codes in “within known limits of applicability” should be expanded to included “within known or demonstrated limits of applicability”
- Beneficial to include more complete reference to applicability of LRF throughout the document
- Several SR clarifications noted “as-built” instead of “as-to-be-built”
- For several SRs, the ISG states that assumptions may be included for DCs, but assumptions may also be appropriate for COLs

Conclusions

- DC/COL-ISG-028 addresses many DC/COL-specific considerations associated with implementation of the standard
- Critical to resolve issue of treatment of SRs with "no action" criteria for CC I
- Industry looks forward to reviewing disposition of comments

Assessing the Technical Adequacy of the Advanced Light-Water Reactor Probabilistic Risk Assessment for the Design Certification Application and Combined License Application

DC/COL-ISG-028

ACRS Full Committee Briefing

September 10, 2015

Presentation Outline

Background, Purpose, and Scope of DC/COL-ISG-028

General Topics of DC/COL PRA Standard Usage

SR-by-SR Evaluation Process

Summary of Comments and Dispositions

ACRS Subcommittee Considerations

Next Steps

Background

PRA Standard (ASME/ANS RA-Sa-2009) endorsed in RG 1.200, Revision 2

- Developed based on current operating reactors
- Establishes high-level requirements (HLRs) and individual supporting requirements (SRs) for the "What" (aspects) of PRA; not the "How" (methods, approaches) of PRA
- Does not specifically address:
  - ALWR designs
  - Pre-operational phases (e.g., Part 52 licensing)
  - Large Release Frequency (LRF)

Purpose of ISG

Provide consistent consideration of the PRA Standard in assessing the technical adequacy of the PRA needed for the Part 52 DC/COL applications

- Supplements RG 1.200, which currently endorses the PRA Standard (ASME/ANS RA-Sa-2009) for current operating reactors
- Will incorporate into RG 1.200, RG 1.206, and SRP 19.0, as appropriate, at next revision of these documents
  - Following issuance of next Edition of PRA Standard

Similar, but broader, effort being developed by ASME/ANS PRA Standard ALWR project team

Scope of ISG

Use for PRA required for:

- DC Application per 10 CFR 52.47(a)(27)
- COL Application per 10 CFR 52.79(a)(46) & (d)(1)

Not for PRA required for:

- COL Holders/Licensees per 10 CFR 50.71(h)
  - PRA required by fuel load and beyond
- Risk-Informed Applications
  - ISI, TS, ILRT, etc.
- These PRAs and PRA applications should address the endorsed ASME/ANS PRA Standard, as appropriate for the application

Only addresses typical DC/COL application conditions

- Does not change current staff positions on approaches

General Topics of DC/COL Usage of PRA Standard

Scope and Capability of PRA

PRA Configuration Control

Peer Reviews/Self Assessments

Operational Guidance and Practices

Large Release Frequency

Technical Challenges

DC/COL Technical Challenges

Site-Specific Features and Characteristics

Screening Events/Hazards for Analysis

Plant-Specific Layouts/Capabilities

Plant-Specific Operating Experience and Data

Plant-Specific Guidance

Interviews

Walkdowns

Treatment of Uncertainties

SR-by-SR Evaluation Process

ISG developed in a manner generally consistent with Section 1-3 of the PRA Standard – *Risk Assessment Application Process*

- *Identification of Application*
  - ***Application for a DC or COL***
- *Determination of Capability Categories*
  - ***Meet HLRs and Generally CC-I (with noted exceptions)***
- *Determination of the Standard's Scope and Level of Detail*

Determination of the Standard's Scope and Level of Detail

Evaluate applicability of SR to DC and COL application stage

Evaluate feasibility of meeting SR at CC-I for DC and COL application stages

- Determine if clarification is needed or additional guidance is needed

General SR Evaluation Outcomes

Can Meet (75%)

- Aspects of SR may need to be clarified for DC/COL application stage

Cannot Meet (5%)

- Aspects of SR may need to be performed - identified by comment/clarification

Not Applicable (6%)

- SR is conditioned on an activity or input that does not exist or is not performed ***OR*** SR is not appropriate for ALWR
- Aspects of SR may need to be performed - identified by a comment/clarification

Replace (1%)

- SR is not appropriate for ALWR and a modified/different requirement is needed

Enhance (11%)

- SR needs to be supplemented to address DC/COL application stage conditions

New (2%)

- No SR addresses the specific topic for which a requirement is needed

Comments on Draft ISG

Draft ISG issued for Use and Comment in November 2014

1 set of comments received (submitted by NEI)

- 49 specific comments
- Staff agreed with 37 comments and made changes as appropriate
- For 7 of the 12 comments the staff disagreed, the staff incorporated clarifications or changes

Also considered

- 2014 Subcommittee discussions on Draft ISG
- Internal comments/edits
- Similar, but different, effort being pursued in PRA Standards community (developing appendix to address the PRA Standard for ALWRs in the pre-operational phase)

Summary of Industry Comments

24 – Edits/Clarifications/Consistency/Corrections

- Editorial/ALWR Terminology (10)
- Consistency (7)
- Clarifications (5)
- Corrections (2)

15 – Assumptions/Uncertainty/Limitations

- COL assumptions (11)
- Uncertainty documentation (2)
- Limitations in peer reviews (1)
- Limitations in computer codes used (1)

10 – Screening Initiating Events/Hazards/Components

- IE-C6 (3), EXT-B1 (2), IFSN-A13-16 (4), SFR-E2

Summary of SRs with Designation Changes from Draft to Final ISG

SR	Draft	Final	Main Influence
IE-A4	Not Applicable	Can Meet	ACRS/PRA Standard/Internal
IE-A7	Not Applicable	Can Meet	ACRS/PRA Standard/Internal
SY-A19	Cannot Meet	Can Meet	Industry
SY-A20	Cannot Meet	Can Meet	Industry
HR-E3	Cannot Meet	Can Meet	ACRS
DA-C4	Cannot Meet	Not Applicable	PRA Standard/Internal
DA-C12	Can Meet	Not Applicable	PRA Standard/Internal
DA-C13	Can Meet	Not Applicable	PRA Standard/Internal
DA-C14	Cannot Meet	Can Meet	Industry
QU-D8	-	New	Industry
LE-F2	Can Meet	Enhance	Industry

Summary of SRs with Designation Changes from Draft to Final ISG

SR	Draft	Final	Main Influence
IFSN-A14	Not Applicable	Replace	PRA Standard/Internal
IFSN-A15/16	Not Applicable	Replace	PRA Standard/Internal
IFQU-A3	Not Applicable	Can Meet	Industry
IFQU-A12	-	New	Industry
ES-B1	Cannot Meet	Can Meet	Internal
PRM-B2	Not Applicable	Can Meet	ACRS
IGN-B4	Can Meet	Not Applicable	Internal
QNS-C1	Not Applicable	Enhance	Industry
HRA-A4	Cannot Meet	Can Meet	ACRS
SHA (all)	Can Meet (COL)	Not Applicable	Industry
WFR-A1	Can Meet	Cannot Meet	Internal
XFFR-A1	Can Meet	Cannot Meet	Internal

ACRS Subcommittee Considerations

Staff identified 3 main takeaways from the August 21, 2015 ACRS Subcommittee meeting

- Seismic Margins Analysis versus Seismic PRA at COL Application Stage
- Scope/Objective to Address Capability Category I versus Capability Category II
- Designations of Cannot Meet or Not Applicable when Action Still Expected

Seismic Margins Analysis versus Seismic PRA at COL Application Stage

PRA-based SMA allowed as part of SRM on SECY-93-087 and reflected in DC/COL-ISG-020 and SRP 19.0

Management is contemplating if a change in policy should be considered

The ISG will move forward with current position; recognizing it may need to be revised if Commission changes position

Scope/Objective to Address Capability Category I versus Capability Category II

Capability Category I identified as generally acceptable for applications for DC and COL in DC/COL-ISG-003 and SRP 19.0

- ACRS/staff have exchanged memos on this topic in context of SRP 19.0, Revision 3

Staff has performed evaluations of SRs for differences in Capability Categories

Summary of SRs comparing CC-I to CC-II

686 SRs in ISG

544 SRs are the same between CC-I and CC-II

142 SRs are different between CC-I and CC-II

- 34 SRs not defined or have no requirement at CC-I
  - ISG approach evaluated if CC-II should be addressed
- 18 SRs Cannot Meet or Not Applicable at CC-I
- 8 SRs become the same as CC-I using general clarifications
- 5 SRs CC-II not achievable at DC/COL, while CC-I is achievable
- 77 SRs achievable at DC/COL at CC-II

Scope/Objective to Address Capability Category I versus Capability Category II

Management supports maintaining the current staff position that CC-I is generally acceptable for these applications

- Recognizes that where CC-I is not defined or does not have a requirement, the ISG considered CC-II
- Scope of ISG limited to application for DC and COL

The ISG will move forward with current position

Designations of Cannot Meet or Not Applicable when Action Still Expected

686 SRs

- 80 are Cannot Meet or Not Applicable
- 606 are Can Meet, Replaced, Enhanced, or New

50% of Cannot Meet or Not Applicable include a clarification that identifies actions that still need to be performed

- Public Comment also was received on confusion regarding these designations that included clarifications

Management agrees with changing the approach so that it identifies the SRs with Qualifications and Clarifications

The ISG will move forward after making this change

Next Steps

Completed all administrative steps for issuance

Will make changes resulting from the ACRS Subcommittee meeting

- Change to Qualifications/Clarifications approach

Issue final ISG for use in late 2015/early 2016

Acronyms

ALWR	Advanced Light-Water Reactor
ANS	American Nuclear Society
ASME	American Society for Mechanical Engineers
CC	Capability Category
CDF	Core Damage Frequency
COL	Combined License
DC	Design Certification
HLR	High Level Requirement
ISG	Interim Staff Guidance
ISLOCA	Interfacing Systems Loss of Coolant Accident
LERF	Large Early Release Frequency
LRF	Large Release Frequency
PRA	Probabilistic Risk Assessment
RG	Regulatory Guide
SMA	Seismic Margins Analysis
SR	Supporting Requirement
SRP	Standard Review Plan
SSC	Structures, Systems, and Components