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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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623RD MEETING

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

+ + + + +

OPEN SESSION

+ + + + +

THURSDAY

APRIL 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 T2B1, 11545 Rockville Pike, at 8:30 a.m., John W. Stetkar, Chairman, presiding.

COMMITTEE MEMBERS:

JOHN W. STETKAR, Chairman

DENNIS C. BLEY, Member-at-Large

RON BALLINGER, Member

SANJOY BANERJEE, Member

CHARLES H. BROWN, JR., Member

MICHAEL L. CORRADINI, Member

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DANA A. POWERS, Member
JOY REMPE, Member
PETER RICCARDELLA, Member
MICHAEL T. RYAN, Member
STEPHEN P. SCHULTZ, Member
GORDON R. SKILLMAN, Member

DESIGNATED FEDERAL OFFICIAL:
PETER WEN

ALSO PRESENT:
CLINTON ASHLEY, NRC
SCOTT BAUER, NEI
ASHLEY GUZZETTA, NRC
JIM HARRISON, GE-Hitachi
CHARLIE HECK, GE-Hitachi
ROY LINTHICUM, Exelon
JOSE MARCH-LEUBA, Oak Ridge National Laboratory
TIM McGINTY, NRC
JOHN McKIRGAN, NRC
ABY MOHSENI, NRC
JIM SHEA, NRC
JUSWALD VEDOVI, GE-Hitachi
BILL WILLIAMSON, TVA
DAVID YOUNG, NEI

T-A-B-L-E O-F C-O-N-T-E-N-T-S

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

(8:31 a.m.)

CHAIRMAN STETKAR: The meeting will now come to order. This is the first day of the 623rd meeting of the Advisory Committee on Reactor Safeguards. During today's meeting the Committee will consider the following, Topical Report NEDE-33766P, GEH Simplified Stability Solution GS3; Draft Proposed Rulemaking for Mitigation of Beyond-Design-Basis Events, and preparation of ACRS reports.

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

We've received no written comments or requests to make oral statements from members of the public regarding today's sessions. 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 portions of the meeting is being kept, and it is requested that speakers

use one of the microphones, identify themselves, and speak with sufficient clarity and volume so that they can be readily heard. And I want to remind everyone in the room to please check and silence all of your little devices.

As an item of interest, the Commission has reappointed Dr. Dennis Bley for his third term on the ACRS, and has reappointed Mr. Gordan Skillman for his second term on the ACRS. And they reappointed me for my third term. And hearty congratulations to Dennis and Dick.

MEMBER POWERS: Rookies, all.

CHAIRMAN STETKAR: And if there are no other members who have any other comments or items of interest, I will turn over the proceedings to Dr. Banerjee to lead the first topic on our agenda, and that's the Topical Report NEDE-337 whatever it is, 66P. Sanjoy?

MEMBER BANERJEE: Thank you, Mr. Chairman. Let's call it just GEH Simplified Stability Solution GS3.

CHAIRMAN STETKAR: Oh, that's a lot simpler.

MEMBER BANERJEE: Yes. It's a pleasure to introduce the staff and the GEH. They will

tell us a little bit about this simplified stability solution which we held a subcommittee meeting a couple of weeks ago in which they made a very nice presentation.

Just to introduce the subject, currently all the BWRs which are not operating in MELLA+ but up to the MELLA+ domain use a methodology to set their OPRM and APRM setpoints which is based on a totally unpronounceable set of words, but it's called DIVOM HCOM.

And this is a rather conservative methodology which sets the setpoints which really correlates the critical heat flux, or CPR critical power issue with amplitude of an oscillation once you enter into this instability mode.

What happens is that because these setpoints have to be set fairly close to the noise levels, and it also gives you some issues with maneuvering, you can have spurious trips which sort of stress the system because they strain the safety systems, they can impact plant aging and all sorts of things.

So in order to try to get a more realistic picture of what would happen once a BWR

goes into an instability, the Applicant has proposed methodology based on best estimate plus uncertainties using the TRACG code.

So this would not apply this methodology to MELLA+ region, operating region which is used in EPUs. For that, also a best estimate plus uncertainty calculation is done, but there are slightly different methodology there which is called detect and suppress confirmation density method.

So that is specifically for MELLA+. This methodology will apply to the MELLA operating region but excluding MELLA+ and will really be used to set the setpoints for what is called Option I-D, Option II, and Option III. I won't bore you with the details of what these precisely are. Okay?

In any case, with that introduction, it should really make things less conservative, and the real crux of the matter is whether we like the way they did these calculations in order to set the envelope and the conditions of the setpoint.

So with that, I'm going to turn it over to the staff. I don't know who is going to lead

off there. Okay, Tim, go ahead.

MR. MCGINTY: Good morning, I'm Tim McGinty. I'm the Director of the Division of Safety Systems in NRR. And it's my pleasure for the Staff to present the Staff's review of the GE Hitachi Simplified Stability Solution or GS3.

Today's presenters are going to be Ashley Guzzetta from the Reactor Systems Branch and Dr. Jose March-Leuba from Oak Ridge National Lab. GS3 is an additional methodology for BWR stability and long term solutions, I-D, II, and III. And I also will not bore you with that demarcation.

It is newly developed TRACG best estimate methodology alternative to DIVOM, which stands for Delta over Initial MCPR Versus Oscillation Magnitude methodology. And I suppose GS3 is simplified in the fact that the acronym is simplified.

The discontinuation of the DIVOM methodology is one of the reasons for calling this methodology simplified. As such, the GS3 methodology takes advantage of modern computational capabilities to replace the DIVOM methodology which is conservative but

unnecessarily complex.

GS3 does not require any hardware or software changes to plants. The Staff has reviewed the information provided in the topical report and accepted it without limitations.

The main conclusion of the staff evaluation is that the proposed GS3 approach for option I-D, II, and III plants provide ample margin for the conditions inside the envelope of applicability and is an acceptable approach to define scram setpoints.

So with that said, I believe that agrees with Dr. Banerjee, so I appreciate the lead-in. At this point, I believe I turn it over to Dr. Vedovi?

MEMBER BANERJEE: It's all open session we're in?

DR. VEDOVI: This is open, yes.

MEMBER BANERJEE: Yes, you have nothing to say that would require a closed session.

DR. VEDOVI: Later on.

MEMBER BANERJEE: Later on, yes.

DR. VEDOVI: Yes.

MEMBER BANERJEE: Not right now though, right?

DR. VEDOVI: Yes.

MEMBER BANERJEE: Okay.

DR. VEDOVI: Good morning, everybody. Thank you for allowing us to discuss GS3 solution. I am Dr. Juswald Vedovi. I'm the engineering manager for stability and radiological analysis GE-Hitachi.

Along with me we have Charlie Heck who is our Consulting Engineer, Jim Harrison who is the Vice President for Regulatory Affair, and Justin Lammey who is a Stability Engineer for our team.

We'll have two sessions, one open session which is this one and then we'll discuss the background information and a little bit of an overview of the GS3 methodology. Dr. Banerjee did a very nice introduction which actually simplified, if you allow me the same information that you're going to share in this session.

Later on in the closed session to where we have to discuss some preparatory information, we'll dig more in details about the specific aspect of the methodology and show you some results and example of the application.

If you go on Slide 4, this is just a

summary table of instabilities that have occurred on commercial boiling water reactors throughout history. The main point is that, you know, instabilities are possible, they did occur, they don't care where your plant is built. You know, it happen in every country that had boiling water reactor technology more or less, and for different BWR types as well.

However, so that's the driver why instability needs to be addressed. And I would like to also mention that in none of these events, the safety limits were violated as a result of it.

MEMBER CORRADINI: So just to clarify, when you say instability, this is for growing power oscillation that leads to trip?

DR. VEDOVI: Correct.

MEMBER CORRADINI: Or it's just a growing power oscillation that could be taken under control. And all of these led to trip and exceedance of the setpoints?

DR. VEDOVI: I believe, I cannot recall if all of them end up to trip. But essentially most of them, they did.

MEMBER CORRADINI: But it's a growing

power oscillation either local or global?

DR. VEDOVI: Correct.

MEMBER CORRADINI: Okay.

MEMBER BANERJEE: Just to clarify for the committee, a growing power oscillation does not have to lead to a trip. The operator can move out of the region. And in fact, one of the reasons, I think, that GS3 is there setting the setpoints somewhat higher is precisely that, that you could be able to maneuver out if needed, right? You've got time.

DR. VEDOVI: Correct. The system has alarms that can be used to give you time to take actions, reduce power and avoid a trip which is a win situation for everybody. And if the setpoints are too low or too close, there is not enough time to take actions. So what kind of --

MEMBER CORRADINI: Dr. Vedovi, would you back up one slide? Is the occurrence date, your slide shows 1982 in Italy and 2015 at Fermi. Has there been a reduction in the rate of these instability events?

In other words, as we look at those dates, it appears as though it's been six years since the last event. Does that communicate that

actions have been taken, at least six years ago, that have really put the brakes on this?

DR. VEDOVI: Well, I would say that if you look at the early stage, a lot of emphasis on operator actions and how to deal with instability events really occur at the end of the '80s, beginning of the '90s with the LaSalle instability event that is in these slides.

So I think that address in some respect the number of occurrences because plants were more aware of we started to look into this phenomena, analyzing, determine the regions more precisely where this instability may occur.

But so to that extent, I think we could tell that from the early stage, '80s, '90s to today's, there is a reduction. But I couldn't draw a conclusion just based on 2009, 2015.

It's just a matter that it's possible during maneuvering that you end up having to trip a pump, getting to low flow conditions and it's possible that you develop an instability.

But the plants have a way, and we've seen this, to ensure that even if you do trip, your safety limit are protected and you don't exceed any limits throughout the event.

MEMBER CORRADINI: Thank you, thank you.

MEMBER BANERJEE: Perhaps you could give a little historical perspective to the Committee as to when after LaSalle, the Owners' Group started to install these different options. So if you would give us when the Options I-D and II, III started to, it was post '88, right?

DR. VEDOVI: Correct. So the 1988 event at LaSalle is what initiated the emphasis on developing long term stability solution and that were put in place fully in 1996.

So during those eight years, there were some interim corrective actions put in place to restrict operation in certain area of the power flow map as a preventive measure to give the time to develop long term solution that will address permanently the issue.

And this solution were put in place starting from 1996, and they were based on the DIVOM methodology. And at that point, that was fine. It was a very conservative methodology. It was understood even back then.

But there were no tools that could do a better job than using conservative approach back then. And also there were no, the limits set out

by other transient event were much higher than stability. And so nobody really was concerned about these excessive conservatism.

As we will see in the next few slides, the situation changed in the last ten years where better techniques, advanced methods improved the capability for transient prediction so the limits of transient decreased. And all of a sudden, stability limits were the one setting up the limits.

And that's when all this emphasis on why we are using such excessive conservatism into the methodology came to affect plant operation.

MEMBER BANERJEE: So how many plants today are stability limited for the oil and CPR rather than, say, turbine trip or whatever?

DR. VEDOVI: I cannot give you an exact number from --

MEMBER BANERJEE: Is it a significant number?

DR. VEDOVI: -- the top of my head, but I would say it's probably is more than five and maybe even ten units.

MEMBER REMPE: So if we have all these conservatisms, why are they still occurring, like

in 2015?

DR. VEDOVI: Well the conservatives, it's in where the setpoint is, it's not in whether or not the event will level off.

MEMBER CORRADINI: Conservatism is, as I understand the way you describe it unless I misunderstand is that conservatisms are driving what I'll call the bandwidth between operation and where you demand a trip to be narrow compared to --

DR. VEDOVI: Correct.

MEMBER REMPE: That's what I'm trying to say that because you narrowed that bandwidth, is that why we're seeing a transient like in 2013 with the trip?

MEMBER BANERJEE: So you would expect more and more instability events actually as you raise the power density and get into more demanding operating regimes. So there's no reason why you would not be unstable. It's whether you can control the instability either by operator action or by tripping.

You don't want to trip, ideally. So you want a reasonable trip setting which will protect the SLMCPR but will not lead to, you know, you

tripping without being able to take other actions.

MEMBER BROWN: What generates the spurious trips? Is it part of the instability itself that's unpredictable, or is it some other --

MEMBER BANERJEE: It can even noise.

MEMBER BROWN: Yes, it's just that the low level of the signals that you're dealing with?

DR. VEDOVI: Yes, I have a couple of slides that show --

MEMBER BANERJEE: I'm sure they'll speak to it. Yes, go ahead.

DR. VEDOVI: So to illustrate what kind of instability we are talking about for operation as there are many different type, and forgive me for a little bit proud of my country.

MEMBER CORRADINI: You don't have the stability ropes on it though. It's got the stability ropes on it, yes?

DR. VEDOVI: Not anymore.

MEMBER CORRADINI: Yes, okay.

DR. VEDOVI: But it shows that I think it's inside fully in a sense that it's a

beautiful masterpiece that dealt with an address, ensure stability for a very long term.

So this instability that you are talking about here is a couple thermohydraulic and electrokinetics and stability. What I'm going to show you here is a video of an animation for reference transient scenario that leads to instability which is a two recirculation pump trip.

What you are seeing here is the radial power distribution into the core. Each of the squares represent the fuel bundle power, relative power. Red indicates where the hottest bundles are located, and the blue colors indicate where less power is concentrated.

MEMBER CORRADINI: Is this axially averaged, or is this peak axial?

DR. VEDOVI: It's radial peaking.

MEMBER CORRADINI: No, I understand you're showing me a radial map. I'm asking axially are you averaging the power, or this is just an integrated power in the bundle?

DR. VEDOVI: These would be the integrated power in the bundle. And you can see also where the control rods are inserted because

there is a depression into the power in those areas. You can follow the events through time and power.

So I initiated a time T-20 seconds. If you follow on the top part of the screen, there will be the trip of wet pumps. Currently the plant is operating at 2,300 megawatts and steady state of --

(Simultaneous speaking.)

MEMBER CORRADINI: One pump, two pump trip?

DR. VEDOVI: Two pump trips.

MEMBER CORRADINI: Two pump trip.

DR. VEDOVI: So right now, both pumps trip. There is a reduction in flow. You can see that the reduction in power follows the reduction in flow. And there is a redistribution of flow into the vessel, into the core.

As a result of that, you can see that now this side of this fuel bundles in this part and this part of the core becomes hotter and starts to excite one of the highest harmonic along this line of symmetry. And you will see development of the regional oscillations where this part of the core start to oscillate out of

phase with respect to this part of the core as you can see now.

Now this oscillations start to be detected by the detection system that is in the plant. And when they reach certain setpoints, the scram is initiated and the event is terminated.

The safety limit were not violated at any point during this event, and this is exactly how an instability event will occur and will be detected and suppressed in actual operation.

MEMBER SKILLMAN: So the time dynamic that we just saw --

DR. VEDOVI: Is realistic.

MEMBER SKILLMAN: It's very fast.

DR. VEDOVI: It can be fast, yes.

MEMBER SKILLMAN: I mean, that was one or two seconds communicating across that large core to cause those changes. So this is a very rapid oscillation.

DR. VEDOVI: The oscillation developed, it can develop in a matter of, you know, 50, 60 seconds to a few minutes or many minutes. It depends on how fast is the variation, if you had one pump trip, if you had two pump trip, you

know, from where you initiated. So it's, how much feed water reduction you have during the event. So there are a number of variables that determine the timing of the onset of oscillations.

MEMBER BANERJEE: But if you took the two pump trip as a limiting event, typically from the onset of oscillations to when SLMCPR is challenged is maybe 50, 60 seconds, right?

DR. VEDOVI: It depends within the plant.

MEMBER BANERJEE: Okay.

DR. VEDOVI: So it can be 60, it can be a couple of minutes.

MEMBER BANERJEE: Yes, so it's not, like, real --

MEMBER SKILLMAN: It's not instantaneous?

MEMBER BANERJEE: That's what I'm, yes.

MEMBER CORRADINI: Was that video realtime?

DR. VEDOVI: Realtime.

MEMBER BANERJEE: Do you want to show it again just for the timing?

MR. HARRISON: This is Jim Harrison,

GEH. Wouldn't you say that it was probably developing before we could see it visually?

DR. VEDOVI: I'm sorry?

MR. HARRISON: Wouldn't you say it was probably developing before we saw it visually?

DR. VEDOVI: Yes.

MEMBER CORRADINI: If you look at the power meter at the bottom, you'll see it developing before you start seeing wiggles, local wiggles.

DR. VEDOVI: Okay, so this is the time where the pump trips. And from this moment on, you essentially are waiting for the inlet subcooling to increase as part of the feedwater reduction.

And at this time, you cannot see here, but the axial power peak will, axial power shift will become more and more bottom peaked as a result of the inlet subcooling.

So this point, you know, is just, it starts to little wiggle, yes, and it start to develop some oscillation. And I do not remember at this particular simulation what setpoint we plugged in for the simulation.

So let's see here. Okay, so in this

case trip of, I'm sorry, at 70 seconds. So that's the order of magnitude for this specific case. But you understand that if the setpoint is increased, you know, it will be delayed, if it is reduced, it will be faster.

MEMBER BANERJEE: So the safety limit, which is of course the critical power ratio plus some uncertainties and things that we add on typically to that mustn't be violated. And that's what the trip tries to do, that safety limit which is the critical power ratio plus uncertainties will be protected so that the fuel is not damaged.

DR. VEDOVI: Correct. So what we have to demonstrate is that with the methodology, we are determining setpoints that are still protecting the safety limit. But you are trying to give more room to the plants to avoid, to buy them time and to avoid spurious signal.

And just in these slides, you know, that's the general design criteria that were really driving the licensing basis for stability in the US. And GDC 12 requires, if you read the last line, that during power oscillations essentially must be reliably and readily detected

and suppressed if they do develop. So that's the whole basis that you're trying to address with the long term stability solution.

And at the very essence, what you just saw there can be summarized in the sense that the measurements that are put in place that create signals that are processed through algorithms that track for a specific frequence of interest and start to count oscillations.

And then when they reach certain setpoints, then when they initiated the scram. That's what you saw in the previous signal.

MEMBER BANERJEE: Perhaps you should sort of lead us through this, the PBDA just so that people understand precisely what it is.

DR. VEDOVI: For Option III plants, the algorithm that is used to detect oscillations is called Period Based Detection Algorithm, or PBDA. This algorithm that is processing the number of signals coming from the plant at all times continuously during operation is looking for period of oscillations within the frequence of interest.

We know what is the target frequence of interest for thermohydraulic instability because

that is determined essentially by the speed of which the liquid goes from the bottom of the core to the top of the core which is linked to the height of the fuel bundle which is fixed, so it's very nice to know --

MEMBER BANERJEE: I have a point to ask you about that. That depends on the subcooling because as you know, there are different models for this. If it's a pure density wave, then it's twice. But if it is a velocity wave at high subcoolings, it can be up to four times.

DR. VEDOVI: Correct.

MEMBER BANERJEE: As you know, of course.

DR. VEDOVI: Correct. But that allow us, because the actual determinate valid conditions for where the instability occur in the plants are not dramatically different from plant to plant.

We can find out a range of frequency where this events may happen. So the algorithm will account for the frequency and a range in between to count for these oscillations. So if a signal develop --

MEMBER BANERJEE: And maybe, Charlie,

you can --

MR. HECK: Well, this is Charlie Heck, GEH. I just wanted to acknowledge what you said, Dr. Banerjee is that it's actually a density wave that we're concerned with.

MEMBER BANERJEE: Relatively low subcooling.

MR. HECK: The density, of course, is what controls the neutronic feedback. So it's the density wave that we're concerned with.

MEMBER CORRADINI: So although things are whipping through the system at higher rates, your worry is the density feedback to the power?

MR. HECK: Yes, that's what causes it to continue to --

MEMBER CORRADINI: So just to ask Sanjoy's question differently, so you're looking at essentially a period based one. But you have an amplitude based trip in others. And for the G3 solution, you're only focused on that and you look at a range of periods?

MEMBER BANERJEE: You still keep the defense in depth, right?

MEMBER CORRADINI: Right, but I thought, I'm sorry.

DR. VEDOVI: The algorithm is the same, right? So this is what --

MEMBER CORRADINI: They're always looking.

DR. VEDOVI: They're always looking and we are not making any change. The only thing that is changing is so the DIVOM methodology will determine where this line which is the amplitude setpoint is going to be.

So the methodology is used to set this line higher or lower. And GS3 is doing the same thing. So it would determine what this line --

MEMBER BANERJEE: So they're not --

(Simultaneous speaking.)

DR. VEDOVI: It is. But --

MEMBER BANERJEE: You should tell them what DIVOM is. It's basically minimum CPR as a function of amplitude, that's what it tries to give you, right?

DR. VEDOVI: Correct.

MEMBER BANERJEE: That's the output.

DR. VEDOVI: So, but at the very base is the methodologies that is used to determine where this setpoint can be in order to protect the safety limit at event, at the termination of the

event.

So let's take this picture as an example. If in this case, let's say this is a setpoint amplitude of let's say ten percent. So if this was the signal during the event, this is where a trip would be initiated.

So the minimum, we can determine what's the minimum critical power ratio reached before the trip occur. So if the amplitude setpoint is higher, the trip will occur later, that's this point. And so the final MCPR will be lower closer to the safety limit.

So if you raise your setpoint, you delay the scram and you get a lower final minimum critical power ratio when the oscillations are terminated. If you decrease the setpoint, you trip earlier and your final MCPR would be higher and you will have more margin to the safety limit.

But of course, as we'll see in the next slide, plants are not operating in a steady state conditions. There is inherent noise in the way that they operate. This is an example of actual data from a plant that shows what kind of signal the detectors are capturing during normal

operation.

And in this case, in terms of relative amplitude, you can see some peaks that are in excess of five percent. And this changes from plant to plant.

MEMBER BANERJEE: The OPRM is typically averaging four signals?

DR. VEDOVI: Correct.

MEMBER BANERJEE: Right.

DR. VEDOVI: An OPRM is called oscillation power range monitor and is a relative average of four local power range monitor that are located into the core and provide normalized signal on a specific region of the core.

So provides a very localized signal that doesn't average the power across the entire core. So it's a very realistic representation of oscillations in a local region of the core.

And so the setpoint, if you come close to this level of noise, you can imagine that if you're in lock in and you have already the confirmation counts and you are pulling the rods, and suddenly you have an increase in an amplitude, you will get a spurious trip.

You don't have any stability, you didn't

need to have a trip. So that's one of the instances where making sure that you have enough bounding of the noise into the plant, it's important.

So too low setpoints interfere with the natural noise of the plant with maneuvering and operation of the plants and can increase the likelihood of spurious scram.

MEMBER BROWN: I want to make sure I understand. This is the background noise on the output of the power range, oscillation power range monitor system?

DR. VEDOVI: Correct.

MEMBER BROWN: Okay, and that's just the variation you're showing over some time period?

DR. VEDOVI: Correct.

MEMBER BROWN: And that's representative, I take it, of longer term. We've got 800 seconds there, so I assume that's consistent. Is this, I just don't know the plants that this stuff is, I know what BWR is but what type of instrumentation is used for this? Is this analog stuff or is this computer based? I know algorithms, when you say algorithm, I think software. That's not a negative comment, it's

just --

DR. VEDOVI: Yes. These are run through the power range neutron monitor system. So there are some that our system is digital. So the system that we are including in the plant's process is a digital system.

MEMBER BANERJEE: But it's digitized. It's an analog system?

MEMBER BROWN: Well no, it starts out with the power range detectors --

MEMBER BANERJEE: Neutron detector, yes.

MEMBER BROWN: -- and that's obviously an analog signal. So you convert those and then you monitor that, and then your algorithm is based on what you've --

DR. VEDOVI: Correct.

MEMBER BROWN: -- what you've analyzed to determine what the noise level is?

DR. VEDOVI: Correct. So it takes all the local power range monitor signal that comes from the plants, those remain the same signals. Those signals are then combined into the back panel of the plant in different channels, and they're sent to process through software that is implementing EPRMs.

And those determine then the logic that may send the signal to the reactor detection system for scram.

MEMBER BANERJEE: So they count?

MEMBER BROWN: No, I understand. I mean, we had tremendous problems with intermediate range noise shutting down our plant, may be plants. And when we went to microprocesser based stuff, we developed algorithms similar to this that literally take the Noise systems out. It took a lot of time to get that refined with the different types of plants we had. So I was just curious as to --

MEMBER BANERJEE: So you do filter and do all sorts of things, right?

MEMBER BROWN: Well most of the filtering is probably done on the software, isn't it? I mean, you do some basic filtering --

(Simultaneous speaking.)

DR. VEDOVI: You're correct, because, as we said, we know the range of frequency so we can cut the frequencies that are outside of this range but still within the range of frequency that may be related to thermohydraulic instability, we cannot eliminate that noise.

As we discussed before, the trend in stability based on MCPR for based on DIVOM methodology have been increased, this OLMCPR and made stability the limiting events. When stability based OLMCPR increase, it becomes more complicated to do a core design. You need to change the amount of fuel bundles that are needed for every load batch fractions and so forth.

MEMBER BANERJEE: So normally the operating limit is set based on transients like turbine trips or whatever. So that limit is usually higher than the stability limit. So the plant is allowed to operate up to the OLMCPR.

But because the stability limit in some cases is actually challenging this, which is very strange, but nonetheless it is, then your plant limitation is limited now, the OLMCPR.

DR. VEDOVI: Correct. So some plants have been essentially forced to try to mitigate this increase in OLMCPR. And the only way that you can do that is to lower your setpoints. But by lowering the setpoints as we saw, now you're increasing the chance of having the spurious scram.

So the unpleasant situation where

utilities have phased, that they have to make the decisions in terms of, you know, what OLMCPR they can afford to have and what setpoints they're going to implement.

And to Dr. Banerjee's point, the actual, you know, resulting operating limit for the plant is really the results of stability, a transient, and core design. So it's really these three function have to come together to determine ultimately what is going to be your operating limit that you design your core fore and that allows you to add margin to the safety limit to accommodate transient and stability event.

So you can have a fantastic steady state operating limit. But if your transient is really bad, it doesn't matter because you have to increase your operating limit to account for the margin for a transient or instability event. And that's what really determines the cycle specific operating limits MCPR.

So that was the premises that really prompted us to advance the methodology they created for some of the tools that now are available such as best estimate codes, fast computing capability, and provide much more up to

date methodology based on realistic analysis to simulated this event and to calculate what operating limit and set points can be implemented.

I will not get into the details on how the current methodology is performed. I think the staff might have touched a little bit on this. But it's very counterintuitive way of simulating what is seemingly a very straightforward transient such as a two recirculation pump trip.

The analysis itself is divided in pieces and is done with different codes, and the results are put together at the end. Each one of these pieces has its own conservatism, and is on unique peculiarities. So it's a very complex process and very conservative.

With GS3, we simulate the actual event from beginning to end with the same code. That's why it's simplified. And we get a little bit more in details in the closed section.

As we say, the aim was to reduce the likelihood of spurious scram or alarms, give more plant flexibility by providing more realistic limits for the plant.

MEMBER SKILLMAN: Let me ask this question, please. Is there a population of transients that describe or describes the boundary condition? Is there one transient that is the limiting transient or are there two or three that when those transients have been factored into the stability solution, you have 99.9 percent confidence level that you have protected the safety margin and the critical power ratios?

DR. VEDOVI: Yes, we have very significant literature and history about that. And certainly, a two recirculation pump trip is the referenced limiting transient for stability. And the reason is that because it results into the largest variation of flow and end up to be at the highest power to flow ratio conditions after the pump are tripped because you go all the way back to another recirculation line.

So those are the high power to flow ratio is one of the key drivers for developing oscillations and also for assessing how is the grow rate of your simulation. So how fast they develop, how big they are, power to flow ratio is one of the key issues, key driver.

That's why the two recirculation pump trip has been in the industry, accepted as the limiting event for stability analysis.

MEMBER SKILLMAN: Thank you. Thank you.

DR. VEDOVI: So in the next couple of slides, just a quick summary of the GS3 methodology. So it's meant to be an alternative to the DIVOM and is using TRACG which is a best estimate system called thermohydraulic and three dimensional electrokinetic models which is used to calculate the minimum critical power ratio at the time of oscillations suppressions and show that the safety limit is protected.

As it was mentioned, because we are using the current detecting suppress system implemented at the plants which is the period based detection algorithm that we show before for Option III plants, or the average power range monitor flow bias scram trip for Option 1-D and Option II plants, therefore there is no need to change, we're not asking to change any software or any hardware in the plants.

We're simply improving the methodology that allow us to calculate what setpoints are going to protect the safety limits.

And as it was mentioned, we have similar methodology that has already been approved and implemented which is DSS-CD but that is used for EPU, MELLA+ operation.

GS3 is leveraging the same methodology and is bringing the same technology to plants that do not operate in MELLA+ and is meant to essentially provide, I like the way that Dr. March-Leuba described it, to bring it essentially in the 21st Century Option I-D, Option II, and Option III methodology.

So it's a kind of bringing the state of the art technology of analysis for those solution and bring it aligned with what we do currently for the DSS-CD.

MEMBER BANERJEE: I guess the real issue here is that we are doing this based on calculations. And you're going to defend this in the future, of course, which is all calculations of stability subject to numerical damping, the numerical diffusion.

And you are going to show us, hopefully, why you believe, we visited this for the DSS-CD that you don't have this problem when you do the calculations here.

I mean yes, you use explicit codes and so on, but that's the crux of the issue, right, ultimately?

MR. HECK: Do you want me to? This is Charles Heck, GEH.

MEMBER BANERJEE: You don't have to in open session because we might ask you really more detail questions --

MR. HECK: Okay. If you ask the question again, I can answer it in the closed session.

MEMBER BANERJEE: And the nodalization, all these things, your validation database, I mean, you have to give us assurance that we feel happy about these calculations.

You've made us happy once before, you actually made Dr. Wallace happy enough that he signed off on it. So it's okay.

DR. VEDOVI: And what we can, what I can say in this session is that the same nodalization and the same model that we used for DSS-CD we used for GH3. So we leveraged all that database and all the demonstration that we did and were approved for GS3.

That's why, I mean, we are saying we are

bringing the same methodology, the same technology to Option I-D, II, and III.

MEMBER BANERJEE: And nothing has happened in those five years of when we looked at this last that has shaken your faith in TRAC's ability, TRACG's ability to predict these things?

DR. VEDOVI: It is not, actually increased it because we keep performing benchmark when we have available data. And that give us more confidence that we are capable of capturing the real phenomena which ultimately is the most important qualification. In fact, in a couple of slides, I'll have the qualification list of TRACG for stability related events.

MEMBER BANERJEE: Yes. It's just that any computer code which is finite difference and not based on a non-diffused method is going to give you damping. There's no way out. So how do you know that you've got a converged answer?

DR. VEDOVI: Well, as you know we have done extensive sensitivities on the nodalization and on the model. And we have proven that it's an acceptable level and we are capable of simulating the instabilities.

Nothing has changed with respect to DSS-

CD because the phenomena is the same. It's just different bloodline. But is the same phenomena, the same transient, and so the same model that is capable of capturing actually more limiting event for MELLA+, of course it's capable of capturing the same phenomena for MELLA conditions.

MEMBER BANERJEE: Well you can argue that, I don't want to get into this esoteric discussion here. But because things grow more rapidly in the MELLA+ region, actually numerical diffusion makes less of an effect than it would in a more slowly going transient. So just a thought. Okay.

DR. VEDOVI: We can come back to later. But we did --

MEMBER BANERJEE: I don't want to go over my time limits.

CHAIRMAN STETKAR: You're already over. Way over.

MEMBER BANERJEE: Really?

CHAIRMAN STETKAR: Yes.

MEMBER BANERJEE: Okay. Please go ahead. They will castigate me otherwise.

DR. VEDOVI: Then as I mentioned, the methodology is based on the same approved methods

for TRACG AOO and DSS-CD and in essence ESBWR stability LPRs.

For the assessment of uncertainty, we used the CSAU, the code scaling applicability and uncertainty methodology that is described in the NUREG 5249. And lastly, to also come to your points, TRACG code has been extensively qualified with respect to stability events and other transient events.

In this slide, it summarize the key qualification case with respect to different test facilities and with actual plant data. We saw with the first slide all events that occur, all the instability events that occurred, and we have a very large samples of benchmark that we perform and are used for the qualification of the code.

MEMBER BANERJEE: So why is Oskarshamn in red?

DR. VEDOVI: Oskarshamn is in red because it's the latest benchmark that we have performed.

MEMBER BANERJEE: And where did TRACG not work well? I don't want to know where it worked well. Where did it not work?

DR. VEDOVI: Well, it depends on what it

means not work well I guess. We were successful --

MEMBER BANERJEE: Suppose you did not tune the code to anything. Were you able to do all this without any form of tuning? Did you get the amplitudes and the onset for those events which could be measured?

DR. VEDOVI: Well, I was not around in '77 so I cannot claim for the --

MEMBER BANERJEE: That's a good answer.

DR. VEDOVI: -- Peach Bottom cases or the LaSalle. But I mean, in the early stage when these best estimate codes were developed, of course there was a lot of work done on developing and finding what models, nodalizations, and numerics, and modeling capability were necessary to reproduce these events.

What I can tell you is that the one that we have been simulating, you know, from the last four or five, we didn't have to cue in the model. We simply tried to model the event as it is.

And the key part is really to get the right initial conditions, the boundary conditions for the event. Sometimes the key part is to be able to get what we call it, the wrap-up or the

core state from when the event initiated.

And that's important to represent, capture the initial state point. But the code, it's really then we let the code simulate and calculate, you know, as realistically as it can.

But we have done so much leg work on the nodalization to validate what you describe before, the medical damping, convergence and so forth that we don't have to do that, tune it on a case specific basis because that would invalidate our basis.

MEMBER CORRADINI: Can I ask Sanjoy's question differently? So you must have a series of figures of merit that when you run an untuned simulation, you look at timing to trip, amplitude predicted versus amplitude data.

What are the figures of merit that you use to decide success or failure? Do you have that list? Or we can talk about it in closed session? We can talk about it in closed session since we're already behind.

(Simultaneous speaking.)

MEMBER CORRADINI: But I guess I'd be curious about these are the five things I look at. So when I do a simulation I look at these

five things that are within my engineering judgement tolerance and then I move on, or I don't.

MR. HECK: This is Charlie Heck, GEH. I think I can address that. What are the figures of merit when you're qualifying your code against --

MEMBER CORRADINI: Right.

MR. HECK: -- these kind of events? You've already mentioned one, amplitude, the magnitude of the, or if it ends up being a limit cycle oscillation, the ultimate magnitude that's reached. If it's a growing oscillation, the growth rate.

If it's a decaying oscillation, for example these low decay ratio Peach Bottom tests, it's how fast does it decay which also addresses the issue about numerical damping. And the fourth one is frequency. Do you predict the right --

MEMBER CORRADINI: Sure.

MR. HECK: -- frequency according to the measured base. So those are the main, main ones. For some of these regional oscillations where you see an out of phase thing, if you have

information, we also had recorded information from Peach Bottom even though that wasn't regional, you would see an axial power shaped shift that's available and can be determined from each of the LPRM levels.

So you should see that timing shift as axial power shape changes up and down. So that's another figure of merit that's evaluated. So I think I covered them all --

MEMBER BANERJEE: I'll tell you what puzzles me about this, and maybe this should be in the closed session. But, you know, this is a very complicated feedback loop in which the fuel participates. And there's of course the gap conductance changes which is always what I worry about.

And so the time constant for these to go back and forth is probably between six and ten seconds depending on the -- or lower is it?

MR. HECK: Four or five.

MEMBER BANERJEE: Four or five, okay. But you know, even when you go to a different fuel or you have something like a fuel at a different burn up. So that's why I'm so surprised that if you get the answers right.

Novak Zuber used to always tell me that if you get the answers right all the time, something is being cooked. You know? When you look at --

MR. HECK: They didn't say they get them right. That's why I asked about what's the tolerance because I'm assuming that the tolerance is --

MEMBER BANERJEE: Because with all these different fuels, all these different burnups, you know, with all these different gap conductances things, how is it that you get it right?

DR. VEDOVI: What we show is that we are capable of reproducing the events and in most case when we are interested in a particular parameters, say power, we are not matching exactly what was in the event, but we are bounding.

So if we can ensure that our predicted power is higher than it's conservative. And so it's okay. We are capturing the evolution of events, we are bounding the data. And so for purpose of applicability, that is acceptable. We don't claim that we can match the exact power peak of each event that occur.

And with respect of timing, timing is one of the most difficult things to capture. But as far as the setpoint calculation goes, it's irrelevant of when the oscillation starts. And we are not have any specific target or calculations that enforces us to calculate well, the oscillation had to develop in 60 seconds or two minutes or five minutes.

It doesn't matter. If they do develop and they do grow, what's the setpoint that is going to the safety limit?

MEMBER BANERJEE: I agree. So the fidelity of this has to be sufficient to ensure that your set points will protect your safety limits?

DR. VEDOVI: Correct.

MEMBER BANERJEE: That's really --

DR. VEDOVI: That's the purpose of the methodology.

MEMBER BANERJEE: We're just giving you a hard time.

DR. VEDOVI: Thank you. And that's everything we have for the open session.

MEMBER BANERJEE: All right, thanks very much. Now I guess we need to hear from the staff

in open session briefly, and then you'll be back, right?

DR. VEDOVI: Correct.

MEMBER BANERJEE: Don't mind us.

MS. GUZZETTA: I'm Ashley Guzzetta with NRR staff and this is Dr. Jose March-Leuba from Oak Ridge National Laboratory. We're going to give a brief overview. I'll turn it over to Jose.

DR. MARCH-LEUBA: Yes, so we're way behind time so I'm immanently qualified to finish this really fast. We are going to skip a little bit through the slides that we have prepared and just give you the points of what the ideas that we wanted to transfer to your minds after this presentation.

Number one is it's a little surreal and the Staff take instabilities very, very seriously. And I as a consultant take instabilities very seriously. Instabilities are real and they can become a real problem if we don't discuss.

We must discuss. Okay? The other problem we have, I'm showing you here real data from plant in which the LPRN, the local power was

oscillating this high. And when you average the left side and the right side of the core and you do the APRN, this is the response you get so that you're having very large power oscillations, there's flow oscillations, there are CPR oscillations and you're not seeing it on your reactor protection system.

So that's why we needed to have this long term solutions which will address this type of instability and scram on time.

Let's go back, I was very quiet during the previous presentation. I want to address a few of the points that have been raised that weren't on my slides at all.

MEMBER BANERJEE: In open session?

DR. MARCH-LEUBA: In the open session. You ask about what has the event, the event frequency been reduced recently. And I'm going to give you some anecdotal evidence.

Back in the early '80s when I was 35 years younger than I look now, and I went to make some stability tests in Dresden reactor. And we were there because I knew fuel what we need to use and we were running some stability tests.

We were there for five days, and at the

end of the day the operator came to me and said what is this stability thing about? The operator was not even aware that the reactors could become unstable.

You go now to the control room of any control room in the United States and the first thing you see is the operating map which in big red area that says instability reaching. Avoid it.

There awareness of operators about the stability has increased tenfold. And that is one of the reasons why the event frequency has been reduced.

Number two reason that it's been reduced is because the fuel elements are really good. The fuel designs that we've had recently are extremely -- if we were running the reactors the way we're running them now with 1980s technology, 1980s fuel, they'll all be unstable.

These new fuels are designed with a stability in mind, and we can go into the terms of why they are more stable, but they are a lot more stable than --

MEMBER BANERJEE: Does it got to do with the time constants because of more subdivision or

what?

DR. MARCH-LEUBA: Mostly with the pressure drop and their optimized spaces.

MEMBER BANERJEE: But now just to ask you this question, would the new fuel which is optimized for higher CPR, again I don't know if I should talk about this in the open session, so if you reduce the flow of course, your CPR performance actually deteriorates, right?

DR. MARCH-LEUBA: That happens with one type of fuel.

MEMBER BANERJEE: Yes, so without naming it, so what you're saying is sort of out of whack with that, right?

DR. MARCH-LEUBA: No.

MEMBER BANERJEE: Because if you do a --

DR. MARCH-LEUBA: If you remember, without naming the fuel by name I think we can talk about this. This fuel is just as good as the old one, as low flow. It's much better at high flow. So when we say that there's a reduction in the flow --

MEMBER BANERJEE: Okay, that's a nice way to put it. Go ahead.

DR. MARCH-LEUBA: Yes, so it's just as

good as the old one was on low flow.

MEMBER REMPE: But Jose, if we know about it and we've tried to address it so much, why are we still having it in 2015 which is what I was trying to ask earlier. I mean, is it, it seems like we should be accommodating, or ending them from occurring, right?

DR. MARCH-LEUBA: Considering how we are running this reactor, we're doing pretty well.

MEMBER REMPE: But it's because we're reducing the margin is why we're still seeing it?

DR. MARCH-LEUBA: The reactors are unstable at low flow high power. And in this particular event we're still evaluating it. We have some information from the plant and it was a reactional flow because it was the pump.

MEMBER REMPE: Okay. It happens.

DR. MARCH-LEUBA: And it happens the same way that turbine trips happen. It's just another AOO, it's nothing to worry about. We have to make sure that the protection works and it protects the reactor.

Another thing I wanted to say is that we've had, again, just we have 15 events there, they're having a lot more than that because the

German reactors are required to unstable once a cycle.

They actually test their limit line experimentally. So there's a lot more events than that. And not a single one of these events have resulted in fuel damage. Okay, fuel damage is of course the way to measure the real impact.

And the calculations show that not a single event has violated CPR. Definitely no fuel damage for sure. So we are doing a good job preventing it. There are turbine trips, there are fuel water heater running and there are lots of pumps, there are instabilities. It's one more AOO.

This slide was trying to address another question that was addressed by Dr. Skillman again. You said which is the limiting event that we have to analyze.

So this is the power to flow map. And we know the stable region is somewhere to the left of this red line. And we've said that before, this red line is a function of 25 different parameters. We cannot do a two dimensional map and draw a line. It's a function of 25 parameters.

But in our mind we can draw it in a two dimensional line, and you can close this line two ways. During the start up going up this way, or you can go forward action to that way.

There are a million other ways to get in, but they're not likely. So when you go during a startup, you're pulling control rods slowly, and they're control, and therefore you penetrate the line just a little bit. So you have an instability, it's going to be a small one and it's going to be no consequence.

The operator is looking at it because he just pulled that rod. He's going to put the same rod back in immediately. So this instabilities, we analyze them but they're of no consequence.

The important one is when you're operating up here and you lose your pumps and you move all the way into unstable region. Then you're very unstable and that is going to be your limiting case. And that's why the two pump RPT is the one that we consider to be the limiting scenario.

I won't bore you, we don't have the time unless you really want to ask the question about what the DIVOM methodology is. Basically it's

correlating the oscillation power versus the loss of CPR, and certainly not HCOM.

You are welcome to ask questions, but we are running out of time. I love to talk about this for three days. So this is our typical limiting transient. It's a two reactor pump, two recirculation pump trip.

So your reactor power is oscillate is here at 100 percent power or whatever. You trip your pump so you're going to have a significant reduction in power immediately. And then slowly, you're going to have a subcooling transient.

And that has to do with the behavior of the feed water heaters and the turbine. And it is that subcooling that typically gets the instability going. So we don't have the stabilities right here during the flow and back. We typically have them 20, 30, 60 seconds later as the subcooling comes.

But if we look in the CPR domain, this is the CPR as a function of time for the same event, you have an initial CPR. And because of the reduction in power, you gain CPR. And now you start oscillating with an increased margin because you have gained some CPR before the

oscillation occur.

If your LTS, long term solution is sensitive enough, you're going to scram even before you get back to where you were, and that is the case in most plants. I mean, what we do, the multi-panel analysis and we have run and we see it in the closed session, every single plant unit that stays is going to apply years three, half of them end up scramming here with more margin than they started with.

And the other half end up scramming here with a slightly less margin then they started with, but with a lot of margin to do safety limit. We will also be showing this slide a lot, you see on the left. And the people from Subcommittee have seen it, have had it burned in their retina. But the other guys have not seen it.

And this is how the operating limit is set in front. You are trying to protect your MCPR of 1.0 which is your safety limit, right, your real safety limit. But you have uncertainties. You don't know what your flow really is, you don't know what your CPR correlation really is. You have a two, three

percent accuracy.

So you have to add all this uncertainties and you try to protect what we call the safety limit so that whenever you hit the CPR, you're very sure that you're not here. So you're having a probabilistic approach.

On top of the safety limit, then you run all your transients and your AOOs. And for example, for AOO number three you have this amount of CPR, for AOO number two you have this much delta CPR. For stability you have this much delta CPR and one of them is going to be the limiting one. That's the one that says your operating limit.

When you add them all up, you get your operating limit. Typical numbers for the operating fleet, I'm about to say what happens is Monte Carlo simulation for every plant in United States, the delta CPR, this number is 0.26, that's the average for all 15 plants that were analyzed.

The delta CPR for stability in GS3 is 0.13. Okay, so you are going to be operating here at 0.26 when you only need 0.13 for stability wise. However, because of the conservatism in

the methodology, some plants, which is five, maybe more, were actually set in their own CPR higher because they thought they needed margin.

And GS3 really brings that into perspective and through analysis demonstrated that they were over doing it. So I won't bore you with the summary. You can read it and we can speed up through the presentation and talk more details in the closed session.

So I will propose that we move into the closed session if there are no questions.

CHAIRMAN STETKAR: GE's up?

MS. GUZZETTA: GE's up, yes.

CHAIRMAN STETKAR: Okay, what we have to do is make sure that everyone present confirms there's no one here that shouldn't be here. We need to also insure that we get the bridge line closed. And we will wait until we have confirmation that that's taken care of.

MEMBER BANERJEE: We have a confirmation density.

CHAIRMAN STETKAR: You're a sick person.

MEMBER REMPE: Just a sick sense of humor I would say.

CHAIRMAN STETKAR: No, he has no sense

of humor, he's a sick person. And we're still on the public record.

(Whereupon, the above-entitled matter went off the record at 9:38 a.m. and resumed at 10:46 a.m.)

CHAIRMAN STETKAR: We are back in session, and the next topic, Draft Proposed Rulemaking on Mitigation of Beyond-Design-Basis Events, and Dr. Steve Schultz will lead us through this.

Steve?

MEMBER SCHULTZ: Thank you, John.

This is a draft proposed rulemaking. This is the state that we're in with this project, and it is the purpose of the committee's deliberation today to determine whether the package that's been developed by the staff is ready to be presented to the Commission and go out for then public comment. And so we're in that phase of the rulemaking.

We've met with the staff many times on this project in various forms because originally there were many pieces coming from the NTTF recommendations following the Fukushima accident that proposed rulemaking in different areas.

This then eventually turned into a consolidated rulemaking package which coupled together a number of different parts of program that made sense to address in concert because of administrative issues as well as technical issues.

So what we're going to hear today is that the consolidated rulemaking package discussion all focused on these beyond-design-basis events. So with that this morning I'd like to turn the discussion over to the staff to Aby Mohseni to introduce the topic from the staff and introduce the participants today.

MR. MOHSENI: Thank you very much, Dr. Schultz. Good morning. My name is Aby Mohseni and I'm the deputy director for the Division of Policy and Rulemaking in the Office of Nuclear Reactor Regulation.

Today we will discuss the proposed mitigation of beyond-design-basis events rulemaking. We presented the proposal to the ACRS Fukushima Subcommittee on March 19th, 2015. Today we plan to go through a similar presentation using essentially the same slides but at a higher level of discussion, recognizing

the much more limited time available for this full committee meeting.

We are seeking ACRS endorsement for issuance of the proposed rule package for public comment. With regard to ACRS endorsement for issuance of the proposed MBDBE rulemaking, it is our view that the proposed rule needs to be sufficient to support informed external feedback such that the NRC using that feedback can produce a good final rule.

Accordingly, you will find that this proposed rule package seeks external feedback on a number of issues for which the NRC expects stakeholder feedback to be helpful in reaching a final regulatory position.

To support this presentation I have several members of NRR and NRO. Tim Reed from my staff will be leading the discussion of the proposed rulemaking. Tim will go through a fairly quick presentation on the proposed rule and supporting guidance.

From NRO we have John McKirgan who will support Tim with regard to the portions of the proposed rule that impact new reactors. Also from NRO we have Clint Ashley who will support

the discussion on draft regulatory guidance that is applicable to new reactors. There are other members from Mitigation of Beyond-Design-Basis Events Rulemaking working group in attendance to support questions from the committee. We look forward to an informative interaction with the ACRS today. I want to thank the ACRS for its flexibility and patience in supporting the staff with our efforts to provide the materials for the committee.

As the ACRS knows, this proposed rulemaking is a high priority action on an expedited schedule. In fact as we speak we are in the last portion of office concurrence. We expect to get the proposed rule to the EDO towards the end of next week.

And now I would like to turn it over to Tim Reed to begin the presentation.

MR. REED: Okay, thanks Aby. Thanks Dr. Schultz. Like is mentioned I'll try to go through this a little bit faster than we went through it on March 19th.

So to start with the background, and Dr. Schultz somewhat summarized this already, as this committee's well aware this is rulemaking that

pulled together, consolidated two other ongoing rulemakings and weaved those into an integrated package that I think works pretty well.

For many reasons, administrative and technical seem to work together of course, as with the Station Blackout Mitigation Strategies rulemaking and the Onsite Emergency Response capabilities rulemaking efforts. And those as a result of that address a fairly large number of recommendations that were in the NTTF report. Those are enumerated on the slide.

Again this should be very familiar to the ACRS. And more importantly, they actually address the actual regulatory actions that stem from those. And those are two orders. EA-12-049, by far the most significant portion of this rulemaking, that's the mitigation strategies order; and Order EA-12-051, that's the spent fuel pool level instrumentation order. Those are both addressed in this and made generically applicable through this proposed rulemaking.

It also addresses the request for additional information from March 12th of 2012, and insofar as it was addressing staffing and communications capability, so that's built into

this also.

And of course I think the committee's very well aware that we're also considering the feedback from the reevaluated hazards that are being currently addressed under NTTF 2.1 and that factors into reasonable protection in 155(c)(2). So all that's being done. That's the scope of this rulemaking. I think most folks here are very well aware of that.

So I'll just walk through this thing very quickly then. It's structured like all rules starting off with the applicability section and then followed by the more substantive requirements. This of course applies to power reactors whether they're current licensees or applicants. And we've developed in such a way as to fold in decommissioning.

So what basically applies to you as throughout your lifetime as a licensee, and we've removed those requirements as we'll talk about at the bottom of the slide, as you proceed through decommissioning process. So that's good rulemaking. We understand the folks on decommissioning. We're trying to build that into our regulation as we go along.

In addition to that it also has new design requirements, new future design features for future power reactors, and that of course is the 155(d), and I have several folks from NRR here that can talk about that in more detail when we get to that later on Slide 7.

Decommissioning provisions I just mentioned. Those are basically to reflect the recent decisions that the NRC's made in recent decommissioning actions. And so we're not carving out any new territory here, but we are in fact trying to reflect that and hopefully by building those requirements into our rule facilitate that process.

So as you remove fuel from the reactor, obviously the reactor itself no longer becomes the concern nor the primary containment. It goes to the spent fuel pool and if you have a secondary containment you're concerned about that. And then once it gets to a low enough level of decay heat, then you can remove everything except what we always call (e)(5)(B) provisions or what's now in 50.54(hh)(2).

So that's the way -- and then once you pull everything out of the spent fuel pool and

just to see you were out completely, so it's that basic structure again. This reflects exactly how we've been proceeding through decommissioning right now. We're trying to reflect that in our rule and facilitate that process. So again no new territory there. That's just trying to do rulemaking correctly.

Now we get to actual, what I think of as the central centerpiece, if you will, of this rulemaking and why it made so much sense to pull it together into one rule and that is the integrated response capability requirements.

And those are requirements that would require licensees to develop, implement and maintain an integrated response capability that includes three different guideline sets, if you will, that were developed for different circumstances under different times, and integrate those with the currently existing symptom based EOPs that many folks here are well aware and in fact probably worked on that went into place after TMI.

So the intent is not to touch EOPs, leave that intact, but then weave these three different guideline sets in there and do that in

a way that develops an integrated response capability and allows the licensee to more seamlessly transition and use those guidelines sets as you proceed through an event. So that's the intent of these regulations.

And the first one, the beyond-design-basis external event mitigation requirements, those are in fact the mitigation strategies order requirements or what's more commonly known as FLEX in the industry or FLEX support guidelines. And so that's about making those mitigation strategies generically applicable, and that is 155(b)(1).

And then the second portion, 155(b)(2) is basically simply transporting into this rule what currently exists at 50.54(hh)(2). And that's the intent. There's no intent here to substantively change any of that work.

So the idea is we're moving in here, it makes a lot of sense to have it here. As folks out in the industry know very well, these strategies are virtually identical in some cases to what's going in place with FLEX, of course FLEX is a much more capable and engineered solution, in my opinion, than what was in

existence before. But they are very similar and it makes a lot of sense for them to be there.

But those are for loss of large areas due to due explosions and fires. That was the circumstance for which they were developed, and now of course what we're putting in place with mitigation strategies beyond-design-basis events is for a site-wide event. It's an indefinite engineered capability, all those functions simultaneously and no sharing of equipment.

So you can see how it's a much more substantial requirement that FLEX is putting in place, but they do work very well by integrating them, in my view, into this paragraph (b). So those are both requirements, either by order or currently in the regulation.

And then finally we come to what I'm sure will be the focus, has been the focus today for many folks looking at this rule and I'm sure it will be for the Commission is the Severe Accident Management Guidelines. And these are currently a voluntary initiative developed in the late '80s and through the '90s and that were implemented as a voluntary initiative in the end of 1998 at all facilities. And as I think the

committee's well aware, following the Fukushima event the NRC staff went out in a TI and looked at that to see where those stood in terms of the voluntary initiative, and found at least in some cases a lack of configuration management or maintaining those over time, okay.

So that's kind of the lesson learned, if you will. That was why these things got brought into integration, in fact, under the Recommendation 8 rulemaking effort.

So the way that's structured is, and I've talked about this extensively before. We've structured that in light of what I think are the risk insights that make sense here is to certainly solve the problem, and that would be putting in place requirements for the guidelines, maintain the configuration of those guidelines both for the plant configuration and for generic changes from the Owners' Group, okay, to reflect these new capabilities which are pretty substantial in terms of FLEX.

But obviously they were designed pre-core damage but you would of course would try to use those post-core damage. So they reflect all that in these SAMGs and of course integrate them

with the EOPs and that as you hopefully are aware that also involves drills, training, and change control folds into SAMGs, what you integrate them into (b)(1). So that's the nature of the three guideline sets that we're trying to integrate into EOPs.

CHAIRMAN STETKAR: Okay, and I'm going to stop you. You're being Tim, so I'm going to stop you right here. You used the word, I didn't count it, the number of times, but you used the word "integrated" quite often.

After Three Mile Island we went through a realization that event-based operating procedures where the operators had to look at specific conditions and decide that they were in a small LOCA inside the containment versus a tube rupture versus some other transient that might look like a LOCA weren't very well suited. So we developed what I'll use the term "integrated", function based, symptom based emergency operating procedures that have served the industry very well, and I agree with that.

We have now devolved into a situation where we are progressively reinforcing that old notion of event based procedures now outside of

the EOPs. We have event based FLEX procedures that specifically apply to, I've forgotten what the quote is but it's something like -- I'll have to read it here. No, I can't find it quickly, but it applies specifically to beyond-design-basis external events caused by natural phenomena that result in an extended loss of all AC power and loss of access to the normal, to the ultimate heat sink. So that's a condition that I have to think of as an operator.

We have fire response procedures which according to the Statements of Consideration are specifically not included in this integration that apply to fires that cause damage and require operators to take a lot of the same types of mitigation actions but for some reason those aren't not to be considered. But I need to understand if I have a fire in a particular location.

We have EDMGs that are stylistically tailored toward losses of particular areas in the plant of a big enough fire and explosion, but not a fire and explosion that might be for a fire that require other actions that sound a lot like some of the FLEX things.

We have SAMGs which you've already admitted include several of the same guidance that are in the EDMGs and now the fire response procedures and the FLEX procedures.

Why don't we think about a real integration that looks at maintaining functions outside the EOPs, rather than having EOPs that just have a pointers to all of these event based responses now that require the team in the control room to say which of these events do I have? Maybe I had a seismic event that caused two fires in the plant. Well, that's not one of my EDMG conditions. Maybe I got one bus available but it's not a safety bus so I don't have an extended loss of all AC power. What am I going to do?

So why didn't we think about that? Why are we devolving into a bunch of event based guidance?

MR. REED: I hope we're not devolving. I don't think we are. Let me see if I can answer it. I've had this kind of, you know, concern or comment come up several times, and I think you've got to view the regulatory framework one way, okay, and then you've got to review what really

goes on the facility and response with another way.

CHAIRMAN STETKAR: Okay, Tim, I'm going to view as if I'm an operator in the control room. So you explain it to me how this has made my life easier.

MR. REED: Yes, I think the response is totally symptom based as the operator. In other words even though I'm talking about, for example, loss of large areas due to explosions or fires where a beyond-design-basis external event, for example, that goes to a beyond-design-basis external event, how do they actually respond to it?

Well, they're going to be in the control room looking for conditions, okay, and if I have no power on my emergency AC buses, for example, 4160 buses, and I can't recover any power offsite, I'm looking at the symptoms right now, I'm basically trying to figure out what to do from the symptoms and guess what they do? Once they figure out that they're in an ELAP they declare an ELAP. So it's simply based --

MEMBER BLEY: They don't care it's an ELAP. They care they don't have any instruments.

That's really John's point.

CHAIRMAN STETKAR: My point is that in Control 7 he doesn't know what's going on. I'm not an attorney. I'm not an attorney. I'm simply responding to what I know. I have X, I don't have Y, please tell me what I should think about doing in these conditions.

MR. REED: Absolutely.

CHAIRMAN STETKAR: Should I think about depressurizing and getting that 500 gpm low pressure pump feeding the vessel? Should I think about maybe getting power back to something because that's the best strategy? What should I, I don't care if I had a fire. I don't care whether I had a legislated type accident because the plant doesn't care either.

MR. REED: That's exactly same responses –

CHAIRMAN STETKAR: And my question is why are we pigeonholing all of this and calling it integration?

MR. REED: Okay, yes, at the regulation standpoint it does look disconnected.

CHAIRMAN STETKAR: No, it looks disconnected at the regulation standpoint which

is a problem, I think, for the agency, and in the implementing guidance. The Reg Guides just say use, they endorse all of the NEI reports. And the NEI reports just say basically, write procedures for these specific conditions and put pointers from the EOPs. So it's beyond the regulations, it's --

MEMBER BLEY: I'll tell you what bothers me about it Tim is where John started. I mean these are for things we don't really expect to see but we might. And I'd sure hate in two years, five years, fifteen years, to have nature teach us once again like at TMI that the way we patch this stuff together isn't serving the operators and therefore isn't serving safety as well as it could.

I mean we've got an opportunity now, it's a shame to miss it.

MR. REED: I think the actual, in other words what I think would be good for you to see, the committee to see is the actual implementation at the plant level. In other words to understand EOPs and the connections, and then I think you'd see it's symptom based in the response. Even though the regulation doesn't

look that way, implementation works that way. So that's the only way you can respond --

MEMBER BLEY: It doesn't look that way in the NEI document.

CHAIRMAN STETKAR: It doesn't look that way in the NEI documents and people tend to write things according to NEI guidance, because if I'm a utility, oh my god, I don't want to be countervailing NEI guidance so I'll write it according to that guidance. And I already have the EDMGs so I don't need to touch those.

All I've got to do is write these FLEX procedures and put some pointers from my EOPs. I have the fire procedures hanging out here in limbo-land. I have flooding procedures which aren't even mentioned in here. Those are also things that are beyond that I need to do. And the operator now has to learn and think about all of these different decision criteria.

MEMBER SCHULTZ: So Tim, to turn around what you said, the more the regulatory framework can look like it's integrated, can really move forward in that direction rather than have words that suggest --

MR. REED: That's definitely something

we would try to get to, yes.

MEMBER SCHULTZ: But rather indicate that this is what should be done, shall be done, then we're headed in the right direction. Right now, if we say well it doesn't matter what we say up here when we get down here, that's not really as we know the way it works.

MR. REED: Yes. I hear the comment. I think hopefully by the final rule we do get closer to that mark.

MEMBER SCHULTZ: See, the problem is the rule language. I can read the rule language, the literal rule language with sort of a broad perspective and say it does not preclude me from doing sort of my concept. If I read the Statements of Consideration which people do read it says that I'm precluded from doing that because I can't consider integrating the fire response procedures. It specifically says those are off the table.

And it speaks about each of those three bullets on this slide as distinct sets of procedures, and furthermore it elaborates on the specific conditions for which each of those bullets apply.

So it's very, very clear to me anyway when I read the Statements of Consideration that these are not considered as an integrated function based response. They're discrete sets of procedures.

MEMBER BLEY: I'd just make one last comment on this if I could. We hear arguments about why the fire procedures shouldn't be involved in this, but if you look back historically, two for sure and depending on how you think about up to four, I think, fires in our history have shown that the lack of integration of fire and EOPs has led to very difficult situations during those events and caused confusion and got people out of the loop who were needed in other places. So we've got some history saying this would be a good idea, in addition to going all the way back to TMI.

CHAIRMAN STETKAR: Well, there's one event where the operators thought they had a fire. They didn't really have a fire but they got meshed in the fire procedures which distracted them so —

MEMBER BLEY: That's right. That's why I say and you know how you think about it, yes.

CHAIRMAN STETKAR: Now one other item so I won't belabor this any further is you did mention drills, and I wasn't going to bring that up. If I look at the guidance, the NEI guidance for drills, the NEI guidance for drills completely reinforces this notion of discrete procedures because the drill guidance as set up is I drill for the EOP transitions to FLEX the FSGs.

I separately drill for the EOP transitions to the EDMGs. I separately drill for the EOP transitions to the SAMGs. I never drill for the integrated set of all of these things. If you could show me wherever the NEI guidance says that I drill for the integrated set of these things I'd like to see it.

MR. REED: Yes, I guess it's interesting, yes.

CHAIRMAN STETKAR: So that reinforces this bilateral transfer to make a decision about which particular procedure am I going to be in, and that's the only way the operators are going to be trained also.

MR. REED: I mean when I write rule language in the section by section, I'm trying to

establish the minimum requirements and clearly what they are, and sometimes that forces me into this box that you're saying. And it's not the intended to mean that for example you have to do them discretely but you want them to choose one of each, you know, for example.

CHAIRMAN STETKAR: That's the path of least resistance that people will take.

MR. REED: Yes, I understand. A licensee would try to get all the, you know, birds with one stone I'm sure if they could, you know, for example.

MEMBER REMPE: So I have a question for what I believe is Slide 2. During our subcommittee meeting there was a lot of discussion about how the Severe Accident Management Guidelines would be checked by the NRC, was it just a check the box, I believe as one member questioned.

And when industry got up they mentioned this letter about auditing and that was after your time. And I just was wondering, is your vision that you'd be doing what was suggested by the BWR/PWR Owners' Group for auditing the Severe Accident Management Guidelines where there would

be a period where the staff would review new ones that are issued and provide comments? Because that never was elaborated in your presentation last time.

MR. REED: Yes, we're certainly, and I think we do talk about it in here. We're certainly very familiar with the work that's going on today and I think, we have an ePortal. I think you're familiar with the offer that was made to the two Owners' Groups to us.

MEMBER REMPE: Right.

MR. REED: And so we have a lot familiarity today and we would certainly be following that. While I don't want to overplay that because that's not an official review, you know --

MEMBER REMPE: Right, it isn't.

MR. REED: -- and I can't say that. You know, we do have substantial understanding what's going on, but that's, I don't --

MEMBER REMPE: If that were the process that were followed it would take an amount of rigor from the staff to make sure that they did review them and provide comments in a timely fashion.

MR. REED: Yes, it would.

MEMBER REMPE: And everybody's stressed on budget and time and stuff like that too.

MR. REED: Yes, absolutely. If we were going that way you're absolutely correct. We would have to put something in place of a somewhat disciplined process, I agree. That's not there yet. And I think that the, and I think you're going to hear it today the suggestion from industry on the commitment for SAMGs. I think they think a commitment aligns very well with what we have as our proposed regulation, and what we are proposing that we probably would inspect at that level, by the way.

So you mentioned inspection, it would be a very high level. Make sure you have them, you're maintaining them, you're affecting configuration management, you write the Owners' Group changes and you're integrating them with the --

MEMBER REMPE: At least the auditing letter lets you review the content. Right here we're just checking the box.

MR. REED: If we reviewed the content and basically there was something that didn't

resemble a strategy obviously then that would not even meet a SAMG. But we know right now it's not there.

MEMBER SCHULTZ: We have time on that and a presentation coming to this later so let's hold it until then on this one.

MR. REED: Sure. Okay. We're at 11:25.

MEMBER SCHULTZ: Go ahead.

MR. REED: Okay, so let me just -- I think I'm done with this slide. So I mentioned integrate probably too many times with the EOPs. Obviously that was just simply to keep all the substantial and good work that was done with the simply based EOPs intact, and that, you know, go revisit that. So that's the idea.

And if you're going to have a site-wide type of response what conceivably can be a site-wide beyond-design-basis external event, for example, leading into this integrated response, then you need sufficient staffing and command and control. And so that's also built into our paragraph (b).

So now I've come to Slide 7 and I'll hand it over to John.

MR. MCKIRGAN: Great. Thanks, Tim. So

I just want to speak to this provision here in the rule. This is a paragraph that's really focused on new reactor applicants, and the requirement here is for new reactor applicants to incorporate into the design features that would enhance the coping durations and reduce or minimize reliance on human actions to achieve the key safety functions that we've talked about in the rule.

So as drafted, this paragraph would apply to new construction permits, operating licenses if a construction permit was issued after the effective date of the rule, design certifications, combined licenses that don't reference the certified design and manufacturing licenses. From a practical perspective we're really targeting the design vendors is the intent here of the rule.

And so what the staff is trying to achieve is to get the designers thinking about this condition very early in the design process so that they can incorporate some of this thinking before the designs become finalized.

So we think this is consistent with the Commission policy statements and we've quoted

some, you know, the policy statements have set the expectation from the Commission that new designs would have enhanced margins, use simplified means to accomplish safety functions including longer times for operators to diagnose and manage challenges, and then simplified safety systems to reduce the complexity of those actions.

So it's the staff's view that new reactors would benefit from longer time and a longer time before they need to rely on portable or offsite resources. So that's the balance that we're trying to strike here.

So the staff has looked at similar rulemakings that the committee might be familiar with. Some similar language and thinking was applied in the development of the aircraft impact rule 51.50. There again the designers were required to address features in their design that would reduce reliance on operator action.

So in essence here the designers have an opportunity to assess the balance between hardened, installed safety systems and portable backup systems and think about the means of simplifying the operator actions that would be

required to implement the strategies that are in essence in this rule.

CHAIRMAN STETKAR: John, you said the word "hardened" but it's my reading of the rule that it only has to be designed to the design-basis of the plant.

MR. MCKIRGAN: That is correct.

CHAIRMAN STETKAR: So it's not anymore hardened than any of the other safety related equipment in the plant.

MR. MCKIRGAN: That is correct.

CHAIRMAN STETKAR: Okay, thank you.

MR. MCKIRGAN: So the rule language is high level. It's a performance based rule. The staff's developed guidance on what our intent is to implement this particular portion. Clint will speak about that in a few minutes.

The rulemaking is as Aby mentioned in his opening remarks going through concurrence. There have been a few tweaks, one in particular in this area where we've added some clarification on what we mean with respect to passive designs for access to the ultimate heat sink. In the case of passive designs we're talking about normal access to the normal heat sink. It's an

important caveat for us in new reactors and so there are a few tweaks going on to the rule.

With that I will pause for a moment and perhaps turn it back over to Dr. Schultz unless there are any questions on this.

MEMBER SCHULTZ: Well, before we go to questions I'd like to take the opportunity for the committee to hear an individual from the staff. In the agency of course we have a process under which an employee can raise an issue and concerns associated with the way a formal process is moving forward. And given that this is a rulemaking process it is a formal one.

And Jim Shea from the staff has moved forward to participate in the non-concurrence process and has filed his opinions to management, and the committee wanted to provide an opportunity to Jim to come here and present to us. And he has taken advantage of the offer and would like to say a few words about what his concerns are and it's related to this particular portion of the proposed rule that is focused on new reactor.

Jim?

MR. SHEA: Yes, thank you. Thanks for

the opportunity. Again, Jim Shea. I am in NRO right now in licensing, but before that I was working on the working group and before that I was actually on JLD when we implemented the orders and before that I was in the ops center when the event was actually occurring. And the reason for that was ten years' experience on shift at a BWR as an STA and a supervisor.

So with that background I think the best way to highlight my issues, I know I wrote them down. I won't go over hand over fist, but just to highlight it is to maybe feed on Dr. Stetkar's, you know, issue about operators and go through a quick fictitious scenario. Take a minute -- I can't talk as fast as my friend here but I will try.

So okay, imagine we're all SOLs, we're at this fictitious future plant, 2,000 megawatts and it's time-zero and a beyond-design-basis external event occurs at time-zero. Takes out my generator and of course 86G, will take out my turbine and also trip the reactor.

So time-zero we're in the control room and all the lights go out, and at the same time we know we lost offsite power, because you know

that instantly because all the control room lights go on, off, the battery lights come on, okay. That's the typical scenario.

So now I know I'm in, really, right away to answer the question, I know I'm in loss of offsite power. So then in approximately maybe five to ten minutes depending on severity of what the external event was I'd have an EO could tell me that our station blackout diesel's not going to operate. So given that, now I know I'm in an extended station blackout.

So ten minutes later one of the things we'll be doing in the control room we would confirm all rods are in. That would be the first thing. So within ten minutes I would know that I'm less than two percent power because on the decay heat curve, rule of thumb, at ten minutes two percent power, LPRMs all down scale -- that's a BWR thing, but -- so in the scenario loss of all AC, loss of DC. We figure out we're not going to get AC back, so if I'm the SRO I direct the lead operator to --

CHAIRMAN STETKAR: Jim, you have DC or not?

MR. SHEA: No. Well, we had the

important –

CHAIRMAN STETKAR: The FLEX says --

MR. SHEA: This is a wholly fictitious thing but we will have DC in phase one --

CHAIRMAN STETKAR: I'm just walking you through the scenarios so --

MR. SHEA: No, I understand. But we may or may not have it, but we'll say we do for this particular scenario. All right, so my lead SRO I ask him to confirm that the ECD is operating. You might ask what is the ECD? It's the new enhanced coping duration system.

And he reports back to me for some reason the enhanced coping duration systems are not operable. And I go -- and his name happened to be Goodnight, and I'm like, Operator Goodnight, it's not going to be a good night.

So I ask the SCA where does this put us? Well, I look at my decay heat curve and I also notice that because of the rule we were able to design our FLEX system that's in the shed out to 72 hours. So I look at the 72, well, can we do anything with that 72-hour shed FLEX pump? Well, unless we get the ECD back we're in trouble because that pump's not going to be big enough to

deal with the decay heat.

So I also know that through a rule of thumb, six hours I have until my inventory in the reactor is depleted and I will have core damage but fuel melting will then start and you'll end up with the core in the bottom of the vessel.

So now we're at a, so that really highlights my concern with this rulemaking. Because I'll go back to what I thought when I was part of the orders, what the Commission found was that additional capability was what we really required. You can't really design for these unknown events that I just, you know, put through a fictitious scenario.

So the issue that you had I thought was, in terms of adequate protection was the fact that you need additional capability, so to leave the operator with something that he can handle that decay heat at six hours or eight hours going forward.

To rely on something that we think we can design, and I think it's really problematic when the NRC thinks we can design something, that's problematic on my end, but I think that becomes problematic and I think we may

potentially leave those future operators without capability.

And so therefore I think that in general this rule is almost contradictory to the rule language in the previous sections about mitigating strategies and doesn't meet the intent of the original Commission requirement of additional capability.

And when we look at that additional capability it's really technology neutral. It's best to look at each plant individually, technology neutral, figure out what they have for coping in phase one, six, eight, ten, whatever hours they have, and then you would add, then apply that flexible equipment.

And what I think this rule language is doing is actually telling certain active plants that might be looking for a license that they shouldn't apply to the NRC or United States even though their containment may be double-walled, they may have robust containment so they may assume the core melts and you'd less release than a reactor that has more passive design.

So anyway that I thought was the best way to highlight my issues on this, and with that

if there's any questions --

MEMBER SCHULTZ: Any questions for Jim for clarification?

MEMBER CORRADINI: Well, just for clarification. So this is particularly for new reactors?

MR. SHEA: Yes.

MEMBER CORRADINI: And your concern is that the language is fuzzy and it needs more specificity or, I'm trying to understand your scenario and how I map it into your concern.

MR. SHEA: My concern is --

CHAIRMAN STETKAR: He missed the ECD.

MR. SHEA: Right, the ECD. The ECD system which is the enhanced coping duration which is the --

CHAIRMAN STETKAR: The new plant installed system that's required.

MR. SHEA: Right. Which I do find very nebulous in a sense that I'm not sure what that is, and along with enhanced, the other for operators is minimize reliance on human actions. I think there's issues there because it's hard to define a success there. How do you define?

So I see this as very problematic for

the licensees in general because how do they design this enhanced coping duration? How do they know it's going to withstand that unspecified future event, you know, that could occur?

And then are we leaving the operator potentially under a scenario where they don't have a pump in the shed that they could pull out to deal with the six-hour and beyond decay heat level. If you look at the decay heat curve at six hours it's approximately, it's about one percent. At 72 hours you've got, it goes down to like three percent, 0.3 percent, and 24 hours is 0.6 percent. So you're not, you potentially are leaving the operator without additional capability as provided in the FLEX.

MEMBER CORRADINI: I want to say it back to you so I get it. So your point is there's a gap.

MR. SHEA: There's a gap.

MEMBER CORRADINI: And your point is the requirement to fill the gap is nebulous at best.

MR. SHEA: Yes.

MEMBER CORRADINI: Okay, that's what I thought you were getting at.

MR. REED: And his non-concurrence is on 155(d) only, okay.

MEMBER CORRADINI: Yes, I'm with you there.

MR. REED: Okay. And I think he's suggesting -- I'm putting words in his mouth, but I think he's suggesting by designing, trying to design capability you may lessen the mitigation capability.

CHAIRMAN STETKAR: That's a little bit of what I got is the notion that the operators are going to rely that I have, I'll call it the super good ECD out there that's only designed to the same criteria as my other safety related stuff that by definition was damaged. And because I in regulatory space can rely on the super good ECD thing to get me out to -- pick a number -- six hours, eight, I don't care what it is, I can then say, well, I only need like a 27-1/2 gpm pump out in the shed with a little gasoline engine on it because by definition I'll be able to get out that far, according to the rule. Whereas, it would better suit me to have that 500 gpm, pick a discharge pressure –

MR. SHEA: As the operator I want the

500 gpm.

CHAIRMAN STETKAR: You want the 500 gpm pumps in there. You can always throttle it out.

MR. SHEA: That's my primary concern. And when you think about it, if you go full circle, I was at the RIC, recent RIC. I noticed when the Chinese presented their flexible approach they were going with, their design was very simple. At six hours we're going to be able to cope with the decay heat on any plant that they have in China regardless if it's passive.

And I also talk about the passive issue. You know, it's interesting because actually this non-concurrence has been in my head since back in 2012 actually. I would have suggested that no new reactors needed to deal with Fukushima because it's just an enhanced design. Because if you think about it, the Owners, the designers, already took the Commission policy statement and built these new reactors with that in mind and built all these.

It's really not, I'd look at the enhanced, the policy statement for advanced reactors not for the staff, it was really for the industry to go out and do good and build these

safer plants. So I think it's a little mischaracterization.

CHAIRMAN STETKAR: I think you're right. This is my own personal opinion. You're right for the passive plants, not so much necessarily when we talk new reactors we're still looking at, you know, active new reactor designs that instead of having two trains they've got four trains of safety systems, but it's just more of the same. It's not clear necessarily how much the active plants gain from that.

MEMBER SCHULTZ: Jim --

Go ahead, Dick.

MEMBER SKILLMAN: Jim, I appreciate the connection between your background and your non-concurrence, and I really appreciate the scenario with Mr. Goodnight who's not going to have a good night. I understand that.

MR. SHEA: I had to throw a little operator humor in.

MEMBER SKILLMAN: That's all right. What you've done is you've described what you don't want and you don't like. So if you're king for a day, in three sentences what exactly would you change?

MR. SHEA: Well, like I said if I was doing my job well I would have non-concurred on NRO having to do anything for Fukushima. Because I was there, wrote the orders and when we first gave them to Summer and Vogtle I was pretty much opposed, but, you know, if you're one guy swimming up the stream it's tough too, and like I go back to this whole passive issue.

And then when I saw the NEI guidance come out and they basically gave all the credit for passive systems on AP 1000, I was concerned about that at the time. But I looked in the context of the fact these are new reactors. This really doesn't matter in my mind. None of this Fukushima thing really applies to new reactors. So I didn't really make a big issue of that.

So it kind of pops up back in my non-concurrence now but, so that's kind of the history of that because I always felt that new reactors never needed this and so maybe that was -

MEMBER SKILLMAN: Okay, so for active plants going forward what would you do?

MR. SHEA: Well, in fact active plants, what I'm saying in short is that active plants

may have more robust capability for mitigating strategies than any passive plant. Because I don't want to name any plants, but let's say you had a plant that needed to employ FLEX within four or five hours because of whatever design they may have, they don't have a steam generator, AFW pump or whatever. Well, that pump's going to have to be a lot bigger than, right, and it's going to be -- and so they will have a much more robust capacity to deal with mitigating strategies. So it's kind of counterintuitive in the direction that we've been going with this now for the last four years in allowing passive plants all this credit.

But I'd just like to highlight the fact that this same scenario, the same scenario I just went through, you could have been the operator in Fukushima 1 and I would have sent the operator, maybe skip the coffee break when he was going to look at the ECD which happened to be in that particular case the iso-condenser which is a passive system. The valve failed. We still don't quite understand why the valve failed.

I have my own theories because I was an iso-condenser system engineer, and I put forth

those theories but we never confirmed exactly why the isolation condenser, first of all they closed it. They shouldn't have, but then why it couldn't be reopened, I have my own theories. Anyway but that's one of the issues you have if you're relying on these as-built design features you don't know what you don't know. I mean the iso-condenser just to be clear is that it has a HELB isolation for a very good reason.

Back in the '80s in a high energy line break isolation on that system that is actually by battery. If you lose your battery you get the isolation on the HELB. It's like a fail-safe. So those valves could have been closed just on the loss of that particular battery bus that's feeding that isolation condenser valve. And then the operators would never be able to open it.

CHAIRMAN STETKAR: Thank you, Jim.

MEMBER SCHULTZ: Jim, thank you very much. Appreciate the briefing. And with that we'll return Tim to the presentation. We're with John still --

MR. MCKIRGAN: I believe I had completed and I was about to turn it back to Tim for the rest of the group.

MR. REED: And so we went to (d), we'll go back to © here for a second and then skip to (e) just to go out of order a little bit and keep everybody confused.

As you're aware, paragraph © of the proposed rule contains the equipment requirements that support the mitigation strategies, the integrated capabilities of (b), and those equipment requirements are entirely limited to two sets of requirements. The requirements that go into place as a result of the EA-12-049, mitigation strategies orders rulemaking, those are at (c)(1), (c)(2) and (c)(3). And then there's a (c)(4), if you will, that is the spent fuel pool level equipment order or instrumentation order, okay, requirements.

So we have those sets of requirements, (c)(1) is a basic capacity and capability requirement. It's to ensure that you have the capacity and capability of the equipment to mitigate basically, you know, something that could be site-wide so you have to build a, simultaneously maintain and restore core coolings, spent fuel pool cooling and containment capabilities across the site, and that places

demands on both the capability of your individual equipment, it has to be able to function under the conditions it's being asked to function as well as the capacity and the amount of the equipment you have to have.

And if you drove down into the guidance, I assume you folks have, you'll see the need for n+1 sets of equipment. That's down in (gg) 1301, it's actually all the way down into 12-06, NEI 12-06, excuse me. So that sets the capacity kind of requirements, and also the amount of time you can take things out of service or have an unavailability of equipment. (c)(2) has been a big focus of everybody so far, and this goes to the reasonable protection of the equipment.

And we in fact have the exact language up there on the slide. The mitigation strategies equipment, this is the EA-12-049 mitigation strategies equipment for beyond-design-basis external events must be reasonably protected from the effects of natural phenomena that are more severe of either your current external design-basis requirements, or if in fact the reevaluated hazard work going on in NTTF 2.1 right now that comes out to be a larger hazard and as verified

by the NRC's assessment of that.

In other words we have to reach agreement of what that hazard is, what the licensees that'll establish that hazard and then that becomes what you need to reasonably protect. So that as you folks well know, you know, was quite about a large amount of interaction with this committee on COMSECY-14-0037. We got the SRM on March 30th. I believe that language is still in line with that SRM, so that issue's being worked very hard right now.

And we do have some challenges. We'll talk about that here in a second about some of the guidance that would support that especially in the seismic area. I think we're going to be probably okay with the consideration of reevaluating flooding hazards but seismic's going to be a challenge. We'll have to figure that out and what to do. So that's (c)(2).

Then (c)(3) is a basic maintenance requirement. It's a set of requirements that would ensure that your equipment remains capable of performance and intended function. So while it says maintenance, it would be maintenance, testing, whatever you need to do to your

equipment to ensure that it remains capable of performing its intended function. So that's a basis requirement on maintenance.

And then finally (4), as I just mentioned, is a performance level requirement that would make generically applicable EA-12-051. And that basically comes out of the order EA-12-051 up in the main body. We didn't incorporate any of the detail. The attachment requirement's in there. So we're leaving it at a high level performance based requirement for future reactor licensees and applicants to see if they can do something better than what's been done to date in that regard. So that's the equipment requirements of ©.

We talked about (d) already. We can skip then to (e) at the bottom of this. Training requirements. These are structured to be a very high level performance based using a systems approach to training. You need to have your, obviously when you think about what we're talking about here today, three guideline sets integrating with the EOPs, those guidelines are not always, although they do have a resemblance to step by step or two-column format if you look

at some of the FSGs, I don't know if you folks have seen that but they are in fact not step by step.

So I think it places more demand, if you will, on the training and the qualification of your personnel to be able to implement those guidelines. So that's the nature of this. However, recognizing that we also recognize that an awful lot of this is really in place. You either have this training, in fact, in place to support your EOPs right now or you're putting it in a place right now to support implementation of the order EA-12-049, and in fact you may even have applicable training in other areas.

As you folks probably know that some of this equipment is basically fire protection equipment that's being used, and so some of the training for that program as one example might be really very directly applicable as well as the training in the EP area.

So what we're trying to do here is establish a minimum training requirement because what we think is really the delta, if you will, is the training really for SAMGs.

And so again with that context of SAMGs

I'm trying to keep a minimal regulatory footprint on SAMGs. I'm trying to allow licensees to use basically everything they have available to make maximum use where there is a differential, whether the delta uses a systems approach to training and then implement training first, and I think it'll be towards SAMGs using that type of approach. And that's the way as you read in the SOC, that's the way it's written throughout the Statement of Considerations.

I mentioned drills already a little bit here. Unfortunately drills requirements become a fairly complex set of regulations because of the unfortunately complex regulatory state that we have between Part 50 and Part 52 and the different kinds of situations you can be in as an applicant and a licensee. But basically it can be simplified to if you're about to get a license then you need to show us you can transition to and use these strategies and guidelines and be uncued. So basically a person who's about to get their license would have to be able to do basically any kind of a strategy or transition to. In other words they don't know which I'm going to ask them to do, so that's the idea

there. It's the initial transition and use drill is to demonstrate that.

And then to follow on from that there's an eight-year calendar period where I think John was mentioning it a little earlier. We talked about the drills, where we want you to perform one of each type of drill during that calendar period. It's written that way as John mentioned as discrete drills but certainly a licensee could do more than one of those at one time and it would be more efficient obviously on their part.

And of course we say drills or exercises because you can then roll these into EP exercises. We recognize that the timing's a little different than EP exercises, so if you go into the stakeholder questions you'll see we're asking about the timing on this versus the timing of EP exercises. We want to give licensees the flexibility to use, make maximal or most efficient use of their resources and so we're asking that question, how does that work, is this going to help you make most efficient use of your resources in trying to do these drills and exercises. So we have a question there. So hopefully that simplifies I hope that's pretty

complex drill frequencies that we have in there.

Finally then we go to change control. As folks are aware the change control provisions that are in place right now are like many things in our regulations, they're geared to look at their exact regulatory area. The most famous and most important, frankly, change control is very extensive over 50.59, and as well, but we have change control provisions in 50.54, and whether it's in security or Appendix, you know, EP and other areas.

And in fact people have fire protection change control procedures out there too. So we have a lot of different change control mechanisms in place right now, and when you go and do these facility modifications as the licensees are all too aware I'm sure, you impact on all these areas in your facility and gets to be a very complex situation about making sure that what you're putting in places mean the objectives of the beyond-design-basis functional requirements you want to achieve, but not degrading anything in terms of like a safety related system structure component or adversely impacting security or adversely impacting fire protection.

And so what we're suggesting is we want a change control for the beyond-design-basis because none of these other change controls do that, and we want to ensure that you also use all those other change control procedures also so that you're basically assuring yourself, one, it's even if it's the exact same system structure component that its function for beyond-design-basis you've addressed, its functions for within design-basis you're addressing. You got them both and you're okay.

And I do recognize there's an enormous amount of complexity. It's been a long time since I've personally been involved with 50.59, but I was a long time ago so I'm aware of that. And hopefully we can get that kind of feedback to see whether there's some disconnects or one stopping the other.

And I think this came up at the subcommittee where, you know, if you think about it in a beyond-design-basis framework you're going to do things, you're going to push equipment or maybe do things like even open security doors that you would not normally do under any, under a design-basis regulation or

format, and we don't want those to stop each other so they've got to work back and forth.

So the idea here is hopefully get a lot of good stakeholder feedback and if there are any disconnects we can remove those disconnects and make them work together. So that's the change control provision.

The other most substantial part of these new requirements are what I like to refer to as the enhanced onsite emergency response capability requirements. So we have what I think of as most of the central piece in 50.155, but then we have what are the onsite emergency response capabilities are in Appendix E, either directly in a current part of Appendix E or an additional Section VII to Appendix E. So that's what this is talking about.

And those basically address several items. First of all, I mentioned earlier about the staffing and communications requirements that went out as a 50.54(f) letter on March 12th of 2012. Those are captured in Section VII and so that's making that requirement generically applicable there.

We also have multi-source term

requirements built right into Appendix E. Right now it would be a single source term. but of course Fukushima Lesson Learned, you can have multiple obviously source terms. And so this would be at one point some people sometimes call this multi-unit but it shouldn't be seen that way.

A single unit can have a source term issue with its reactor and spent fuel pool so it's multi-source term, and of course this can get very complex with multiple units and multiple spent fuel pools. So this is being put in place right now too and that's in Appendix E, built right into Appendix E.

And then we have basically I think of it as an administrative clean up on ERDS and to reflect the removal of a reference to a modem technology which is no longer used so we're removing that technology reference and making it not reference technology and hopefully you won't get into that disconnect in the future. So we're cleaning that up as we go along as part of this rule.

Finally, well, two more things. Application requirements, we have contents of

application requirements of both Part 50 and Part 52. They're made to be parallel although this process is obviously very different. We tried to structure that whether you go under Part 50 or Part 52 you're going to be submitting the same types of information from both, and this of course is if you're going to come in for a new reactor what kind of information we want you to provide with regard to this new regulation so that we can review that and to judge whether your application is acceptable or not. And there's quite a bit of regulation in there.

And then, finally, the implementation requirements. I think it was at this committee I think provided feedback on the implementation requirements that was at one point, in fact I've heard it through the concurrence process and also from industry, I believe, too at the last subcommittee, so implementation requirements right now as the rulemaking sits right now and it can of course change, it's not through concurrence yet.

I've revised that to a four-year implementation period as opposed to two refueling outages, so that's to reflect some of the

feedback we hear. I think that makes more sense. Now I'm going to put a big caveat on that because it depends on how things actually shake out on implementation of reasonable protection on some of those.

On the reevaluated hazards I don't foresee that to be an issue, but if that becomes an issue downstream that could be something you'd want to tie to a refueling outage because this could be a re-working modifications.

But what we foresee right now in terms of implementation would be focused really on SAMGs because as a vast majority of this regulation that we're proposing is actually in place or going into place right now. And so really the overhang, if you will, the delta is largely in SAMGs, and they don't need to be in a refueling outage to do those kinds of changes.

So that's the idea, we think four years is sufficient. So of course we'll pursue that using our process, as you folks are aware, the cumulative effects regulation process to determine whether in fact we've hit the mark there, what else we're going to put on that, and if we have to make adjustments to implementation

of the final rule certainly we'll consider that input at that time.

So that gets me through the proposed rules language and now I'll move on to something on the backfit and some of the supporting analysis.

MEMBER SCHULTZ: Tim, would it make sense to pause here and have industry come up and make their presentation? Let's do that and make a quick transition.

MR. REED: Sure. I'm flexible.

MEMBER SCHULTZ: Because we had scheduled them from noon to 12:15.

MR. REED: Okay. Sure.

MEMBER SCHULTZ: So let's make that transition now and we can do that quickly and move forward.

Thanks, Tim. We're still moving forward. We did start 15 minutes late but we want to stay on the window schedule that we have to the best of our ability. So we'll go ahead and start.

David, I'll turn it over to you.

MR. YOUNG: Great. Thank you. So good afternoon. My name's David Young and I'm a

senior project manager in the Emergency Preparedness Department at NEI, and with me are Roy Linthicum from the Pressurized Water Reactor Owner's Group and Scott Bauer from NEI. We appreciate this opportunity to provide industry comments on the proposed draft Mitigation of Beyond-Design-Basis Events rule.

So my friend here, Roy, is on kind of a tight schedule right now, so what I'd like to do if we can, go right to Slide 7, and we'll let Roy do his thing and then we'll come back and start off then with Scott and go through the rest of the presentation.

MR. LINTHICUM: And I do apologize. I actually have a webcast I have to host which is why I have to leave, and we've got about 100 industry people calling in so I can't miss that.

So what I'm going to talk about is actually plant indications and instrumentation for use during severe accidents primarily as used by the SAMGs. Both Owners' Groups actually in their SAMG guidance provide guidance to determine and actually validate the instrumentation readings that they have. We know that you can't necessarily rely on the instrumentation

readings directly. There can be a lot of uncertainties as far as what you're reading. Also potential power issues, you may not have power to provide instrumentation. So we do use and look at all possible instrumentations that could provide us a help in determining what the functions are that need to be addressed.

We look at alternate instrumentation. We looked at linked parameters such as both pressure and temperature to make sure we're in the right place. And really what we're looking for when we talk about SAMG instrumentation is we're not really focused on absolute readings, we're really looking at trends and changes in trends. So we don't necessarily need to know the exact value, but we're trying to understand the progression of the accident, are things getting worse, is containment pressure going up or going down, are the actions we've taken in the SAMG actually been effective?

And then for those instrumentations where we know we don't have available instrumentation, we actually are providing calculational aids so we can actually calculate where we expect to be based upon the conditions

we've seen rather than relying on instrumentation.

And then lastly, we are develop --

MEMBER BROWN: What do you mean by conditions you've seen?

MR. LINTHICUM: Conditions are times, so one of the ones --

MEMBER BROWN: I mean how do you evaluate the conditions if you don't have any instrumentation?

MR. LINTHICUM: Well, we expect to have some instrumentation. Most of the instrumentation we rely on to implement the SAMGs is actually also instrumentation that we're going to be powering up for use as part of the FLEX guidance. So we do expect to have some instrumentation available. If we don't we have calculational aids that look at, you know, how much time we've had since the accident has occurred and when we lost instrumentation and we can calculate where we expect to be and then make decisions based upon those types of calculations.

MR. YOUNG: So it looks like a simple example might be a Heat-up rate, just a very simple example.

MR. LINTHICUM: A Heat-up rate. One for us in the PWR side, hydrogen concentration is a major item where we know we're not really going to have instrumentation so we have a calc aid to determine how much hydrogen we expect to see in containment.

MEMBER BROWN: That assumes that the plant's intact though I guess.

MR. LINTHICUM: It assumes, if you're go into SAMG space it assumes that you've actually started melting the core. We don't get into the SAMGs until you've had the onset of core damage. But we know when we transitioned, we record that information and, you know, we base everything on the core exit thermocouples when we transition, then we can estimate hydrogen concentrations based upon that information. Like I say it is an estimate, it won't know exactly, but we don't need to know exact information.

MEMBER BROWN: Okay, thank you.

MR. LINTHICUM: Lastly, we are developing training material for the operators and the technical supports at our staff and part of that focus will be on the importance of validating any instrumentation response and not

relying directly on one instrumentation that you see.

We know you can't, like I say there's going to be a lot of questions as far as the complete accuracy of the instrumentation and we need people to focus on trends, not necessarily those absolute parameters.

MEMBER CORRADINI: I'm sure you're going to ask a question so I was going to wait for it, to look to you.

MEMBER REMPE: Thank you. Okay, my understanding is both the BWR and PWR Owners' Group based on presentations that were given at MPRC meeting, that recent meeting as well as other places, they're updating the guidance for Severe Accident Management and consideration of the instrumentation. I've heard from the PWR Owners' Group that they're looking at a lot of different scenarios. Are the BWR Owners' Group looking at more than one scenario? Because I know that they're focusing a lot, and maybe it's just what I've seen presented on what happened at Daiichi, and are they going to look at different types of scenarios and update the guidance on a lot of different scenarios or just

one?

MR. LINTHICUM: I believe, and Bill Williamson are you on the phone?

MR. YOUNG: Is there a way to open the line?

MR. LINTHICUM: I believe the answer's yes but I'm not tied in directly with the BWRs. But I believe we have a BWR representative on the phone.

MEMBER REMPE: Haven't seen them presented but I just would like to --

CHAIRMAN STETKAR: On the phone, he could comment during the public comment period.

MEMBER REMPE: I tried to ask questions with the public comments during the subcommittee when he came on and I was told I couldn't, so let's make sure we get that answer please.

MR. YOUNG: He's alerted.

MEMBER SCHULTZ: David? Go ahead and ask.

MR. YOUNG: Bill Williamson, are you on?

MR. WILLIAMSON: I'm on.

MR. YOUNG: There you go. So did you hear the question, Bill, or do you need it rephrased?

MR. WILLIAMSON: I believe I heard the question.

MR. YOUNG: Can you give us an insight on that?

MR. WILLIAMSON: Yes. This is Bill Williamson, TVA and Browns Ferry and the BWR OG. Right now we are primarily looking at the instrumentation needs from the Fukushima Daiichi, the three different sites, but before we finish we will look at other scenarios also in order to keep the symptomatic nature of our plant.

That'll usually say we're going to look at something like an ATWA, something like the designed station blackout, small break LOCAs, large break LOCAs, and just make sure everything is still working the way we believe it should. So a short answer following my long answer is that yes we're going to look at other scenarios than just the extended station blackout.

MEMBER REMPE: Thank you.

MEMBER SCHULTZ: Go right ahead David.

MR. YOUNG: So any other questions for Roy before he needs to leave?

MEMBER CORRADINI: Yes, before you go off and become the host, so in terms of both the

Owners' Groups, are you trying to develop a minimum set of the instrumentation with the current VQ and say with that in trending that will give you enough to essentially lead you through the SAMGs? That's what I hear you say but --

MR. LINTHICUM: It's the basic concept with backup instrumentation as well.

MEMBER CORRADINI: Okay, has that minimum set been determined or are you in the process of determining it? The way Bill said it on the phone is I interpreted that you're in the middle of determining it.

MR. LINTHICUM: Where we're at on the PWR side is we have drafted where we want to be with our enhanced SAMGs which covers and brings all the PWRs under one set and we're in the process of validating that effort. So there's still some work to be done. We're not complete yet.

MEMBER CORRADINI: Okay. And validating it means you run through a series of what-ifs and then see --

MR. LINTHICUM: Yes.

MEMBER REMPE: Actually Bob Lutz's

presentation at MPRC identified a set of instrumentations and when questioned he said we're in the process of validating by going to different plants -- group of operators?

MR. LINTHICUM: Well, yes, it's going to be validated at different plants because we need to address the three different NSSS sites and make sure that given the set of instrumentation we have that we can actually implement all the SAMGs. So we do have a set that's been developed. but I'm not going to say it's complete until we've been through the validation effort.

MR. YOUNG: And initially I just was thinking, so hey, Bob Lutz, are you also on the line?

CHAIRMAN STETKAR: He is.

MR. YOUNG: Okay, so Bob will be able to speak to that too if he's unmuted.

MEMBER SCHULTZ: We've closed the line.

MR. YOUNG: Oh, have you, okay.

MEMBER SKILLMAN: Roy, I would offer this comment. We went through this 36 years ago. And on the P side there's probably some pretty good information that would identify a minimum set of instruments that you need.

MR. LINTHICUM: There is, yes.

MEMBER SKILLMAN: Pressurizer level, containment level, gas concentrations, radiation levels, before you lose your pumps' pressurizer level after you've lost your pumps' vibration. But we lived this in March of 1979, so there's probably a good place to start.

MR. LINTHICUM: Right, yes, we are not starting from scratch, but like I said we are making a significant change to our SAMG process. It's really the first significant change since we first developed them in the '90s. Like I say, part of that is to put all of the PWRs on the same footing all using the same set of guidance at this point.

MEMBER SKILLMAN: I would make one other comment. Once you've lost the core it becomes a containment issue.

MR. LINTHICUM: It absolutely does.

MEMBER SKILLMAN: And really buckling down containment and knowing its physical condition carries the day because that is where the radiological questions begin to arrive.

MR. LINTHICUM: Right. And part of our process is part of what we're looking at, and in

the SAMG space we are all function based and we are primarily focusing on containment, protecting containment, actually protecting the steam generator tubes to make sure you don't have a containment bypass event at that point as well. So it's something a little bit lacking from the original SAMGs and we want to provide that guidance on and make sure people are prioritized on protecting containment once you get into the SAMGs.

MEMBER SKILLMAN: Thank you.

MEMBER SCHULTZ: Hearing no other questions for Roy, thank you very much.

MR. LINTHICUM: Thank you.

MEMBER SCHULTZ: And David, you can continue with your presentation.

MR. YOUNG: Will do. Well, with that then if we can kind of go back to, I guess it would be the second slide, and I'll go ahead and turn it over to Scott to talk about mitigating systems.

MR. BAUER: So let me answer the question at hand, I think, from an industry perspective. The industry does support sending the proposed rule to the Commission for their

consideration for issuance as a proposed rule for public comment.

One of the reasons for that is we really need to get the rule back out into a public arena to where we can continue to comment on it. We do have two reservations on that though but we don't believe those reservations stop us, should prevent moving the rule through to proposed rule status. And those two reservations are with regard to how the reevaluated hazards are being incorporated in the rule.

Obviously with the recent SRM on the SECY 14-0037 there's uncertainty as to what the future holds for how the reevaluated hazards are going to be addressed and how they should be factored into the regulation. And then, you know, I think as Tim was about to get to, comments on how to incorporate the SAMGs if they don't meet the backfit analysis requirement.

So with that said, I'll talk about the reevaluated hazard issue a little bit about some of our concerns. And I think these were mentioned at the March 19th meeting when Brian Ford was here, but the number one concern is we believe the reevaluated hazard is in the wrong

position in the rules, in paragraph (c)(2) under equipment and just says you should protect that equipment reasonably from the reevaluated hazard.

Well, what we have proposed is that you may need to develop additional mitigating strategies for the reevaluated hazard so there really should be two options on the rule which are on this side. Number one is I can maintain my FLEX capability for the reevaluated hazard and I'm done, or I can make modifications to my FLEX strategy and still, and make it work and I'm done. That's the first bullet.

The second bullet though is if I can't do that and modifying the FLEX strategy is not reasonable then we're going to develop an alternate mitigating strategy to basically deal with the reevaluated flood hazard. And I say flood right now because the guidance we're developing only addresses the flood hazard.

So (c)(2) basically says the reevaluated hazards with an s, and blind seismic and flood both from the 50.54(f) letter. Right now the only guidance being developed is for the reevaluated flood hazard. There is work being done on seismic, but we're not anywhere near

having guidance. So we wouldn't be able to follow the cumulative effects of regulation provision that we have guidance that goes out simultaneously with the rule on that issue.

MEMBER BLEY: I'm sorry. I could see how one could interpret the top bullet as allowing you to do this. This is just trying to be precise and say that we might have to, maybe modifying the strategy isn't enough, we might have to do a completely new one.

MR. BAUER: Yes.

MEMBER BLEY: Okay, which seems a really fine point to me, but okay.

MEMBER CORRADINI: So you're going to give an example of that? I was trying to understand it too.

MR. BAUER: Okay, I can give an example. When we were here previously with, we had Dominion up here and we gave an example. But, you know, if the reevaluated flood hazard is such that it would be, well, first of all, FLEX starts off with the initial conditions of I have an extended loss of AC power and loss of normal access to the ultimate heat sink. So basically we said we don't know what event caused

this but here's the result of the event. So it's a, you know, we start with a consequences then we say develop strategies to mitigate those consequences.

So in the reevaluated flood hazard, if those strategies would still work for the reevaluated hazard or I can modify those strategies reasonably to make them work, I can stay with that same set of initial conditions and initial assumptions. If I decide that I cannot do that reasonably under the alternate mitigating strategy or the targeted hazard mitigating strategy provisions which discuss on this slide, I would start the event with okay, here's my flood, now let me figure out what the initial conditions are that are caused by that and I would not necessarily assume an extended loss of AC power nor would I assume loss of normal access to the ultimate heat sink unless the reevaluated flood hazard caused that.

MEMBER BLEY: To me this gets us back to where we were discussing these things being, all of these procedures, all of them together being so event-driven that we lose the flexibility to respond to functionality. And man, if we're

looking at it this way, this reinforces my worry about that.

MR. BAUER: Well, you know, I was talking to some, or trying to whisper to some colleagues about our reaction to the statements of what you were asking Tim up here with regard to that. We believe the procedures are still symptom based.

Now they are, you know, when we revised the emergency operating procedures to sequence through to recognize the conditions that would exist when I have an extended loss of AC power or what would I see that would make me declare or determine I had an extended loss of AC power, and then those symptoms would drive me to go to the FLEX support guidelines. And then those are indication driven and that you go out and you determine the status of all of your equipment and say what components do I have available now to deal with the conditions I'm seeing and the symptoms I have? So we believe it is still strongly symptom based.

Understand the word integration, understand we're dealing with a particular hazard condition. This ultimate --

MEMBER BLEY: I'll just throw the last word in, it's just smelling to me like we're telling the operators, man, if you can't meet the definition of using this, just sit there, you know, you don't have a way out. And that's what's worrying me. And you were picking on this makes me worry about it even more.

MR. YOUNG: Let it melt and the SAMGs will take care of the public.

MEMBER BLEY: I'm sorry David.

MR. YOUNG: No, no, don't be sorry, but I think in this case I might suggest that, you know, particularly for these categories -- and I think Scott's right. I think for the FLEX stuff that is much more symptom based, I think, then maybe is what was portrayed here this morning.

But, you know, something like this, you know, these are a little bit more event based because these are things where you would have in many instances advanced warning of the flooding event, you know, the dam broke. Or you had the long, prolonged precipitation events in the upper Midwest that you know the river downstream's going to flood in six days.

So these things, I think, you know, lend

themselves a little bit more to an event based kind of response because the event is what is going to --

MEMBER BLEY: I understand what you're saying.

MR. YOUNG: Okay.

MEMBER BLEY: But I still have this sense that we're painting the poor guys into a spot that if I can't meet all the rigorous definition of using this I can't use it, and that just takes me away from --

MR. YOUNG: Yes, I mean I think there's been videos that we have done. I don't know if you've had an opportunity to see some of them, but I mean we've done some of these simulator videos where we've sort of filmed this stuff. And I think it looks and smells really like a symptom based approach where you're getting into FLEX.

MEMBER BLEY: I'd like to see that. I haven't seen those, but, you know, what you just talked about if that's what happens this is going to work great. But if it's something different and it doesn't meet that definition, we're almost saying well, then you don't use this. And it

might be just the right thing to use for the thing we haven't thought about yet.

MR. YOUNG: Well, yes, but at the end of the day the operator still always has the opportunity, if he's in some nebulous space, there's always X, right? I mean he's like I can always declare X, and go get the pump and do what I got to do, or go get the battery charger and do what I got to do. So I don't know that it's precluded.

CHAIRMAN STETKAR: It's not precluded, but operators tend, if they're trained to use specific procedures under specific conditions they want to do that. That's the problem that we have with the fire procedures.

People have gotten into problems where they've said, my god, we have a fire so we have to do this but the EOPs tell me to do -- what do I do? Because there's not that coordination. If they're trained to follow a particular procedure for a particular set of conditions that's what they do. Follow the procedures. My god, if I don't follow the procedures somebody going to throw me into Leavenworth if not kill me.

MR. BAUER: The same groups that

developed the current EOPs, the PWR and BWR OG procedure subcommittees are the ones who have developed in a large part these FSGs. So they basically went back to the EOP and said well, where, you know, symptom based, when would I declare an extended loss of AC power, and then it directs you to these FLEX support guidelines. So the same thought processes were used.

And I think you have to start with, what's the event I'm dealing with and then what are the symptoms of that event going to be to build my procedure.

CHAIRMAN STETKAR: Our whole point is that you can't think of all of the events. So if you tailor those procedures to those events you're putting the operators in a pigeonhole which will not work for the events that you haven't thought about.

MEMBER BLEY: Which might make them turn a double blind and create confusion in places where it's not necessary.

MR. BAUER: Understand. Okay.

Okay, so, and in this next slide we thought more since the March 19th meeting about potential ways to word the rulemaking to deal

with the issue I've mentioned on the previous about how to move the requirement to have a mitigating strategy up into (b)(1) where we believe it belongs as opposed to having reevaluated hazards just in (c)(2). That's what that slide was for.

MEMBER SCHULTZ: And that Scott is you've moved the language to a different place or is it created language that --

MR. BAUER: No, we capture the idea that we want to talk about the requirement to have a mitigating strategy for these events not just protect equipment for the event.

MR. YOUNG: Yes, so let me elaborate on that for just a moment. I mean that is what this proposed wording is trying to get to is that we think this wording accommodates the use of alternate or targeted mitigating strategies, strategies beyond the FLEX strategies, and allows you to do so looking at a hazard-specific, site and hazard-specific analysis. And if that by the way tells you have different initial conditions then the FLEX assumptions of total loss of AC power, loss of access to the ultimate heat sink then that's okay, then those are your initial

conditions because you have the analysis that tells you what those are. So that suggests the wording does two things. It addresses both of these items here.

MR. BAUER: The targeted hazard mitigation strategy wording is our terminology for Recommendation 2 that was in the SECY-14-0037 which the Commission approved.

Okay, moving on. So we are developing an Appendix G to NEI 12-06. It's been drafted by the industry and we're basically holding it at this point. But it does address how to do the mitigating strategies for this, you know, if you can't, well it talks about can you make FLEX more, can you modify FLEX or do you have to go to the alternate or targeted hazard and how to do that.

And as soon as we get back into the discussion mode on this and understand what the full impact of the SRM is we'll start engaging the staff on what we're proposing on how to do that mitigation strategy development.

MEMBER CORRADINI: Can I ask you a question? Because your example, because it's flooding, implies that there's a time element

that allows you to prepare that doesn't exist with the assumptions in FLEX for the ELAP which is just instantaneous, here's your damage state. But if you were to think of seismic, wouldn't that take you directly into you'd have to survive that with the FLEX equipment because there's no warning? There's no time window that allows you to deal something, deal with it differently. So you can't be, I don't want to say sequence based, but you can't be event based in that regard.

MR. BAUER: Yes, so for both flooding and seismic there may be an instantaneous event, there may be a delayed event. So the development of the strategy would allow you to take into account, I mean obviously for seismic it's going to be probably an immediate.

MEMBER CORRADINI: And that's a segue to the second bullet, right? Is that we're still working on the --

MR. BAUER: Right. I mean we're still working with the staff on how to figure out to develop mitigating strategy for seismic, whether the SPRA is for plants, you know, how plants are going to get screened in and out of whatever condition they, you know, whatever bin they fall

in in seismic, whether the SPRAs answer the question we're trying to figure out the guidance for how to do the seismic in the strategy.

For flooding we're a little bit more, well, obviously we could develop this Appendix G so we believe we understand how to move forward with a flooding mitigating strategy.

MEMBER BALLINGER: But it's possible to have a simultaneous seismic event failure of a dam and then get flooding, so they're not disconnected from all that.

MR. BAUER: Right. So the flooding event may be caused by a seismic event, and then depending on where the dam is you may have warning time or you may not. So warning time is built into the development of the strategies to determine with my new flood hazard do I have warning time, yes or no, because then that helps you to figure out the time it takes to respond, what I can do? Can I shut down the plant prior to the event? You know, can I make a lot, you know, understand the flood is coming I have time to take some actions as opposed --

MEMBER BALLINGER: But the seismic event may have put the plant in a damaged state which

hurts you with respect to responding to the flood.

MR. BAUER: Yes, understand. I mean 12-06 currently says don't take multiple events simultaneously, so I mean we would have to take that in, you know.

MR. YOUNG: But all that engagement in the analysis space and how to apply that in the reevaluated hazard space is work that needs to be done. I mean there's a conversation still to be having.

MEMBER RICCARDELLA: So will there be another appendix like Appendix G to address the seismic --

MR. BAUER: That would be the thought would be Appendix H would be the next one and we'd develop potentially a way to develop a mitigating strategy for seismic events. But we're still in the stages with the staff of trying to figure out what the path forward looks like there, so we're not nearly as far along as we are on the first one.

MEMBER RICCARDELLA: Then the words in the rule are adequate protection for this, I mean are you opposed to those rules? I mean these

appendices presumably will eventually give us adequate protection against both seismic and flooding of the strategies.

MR. BAUER: I guess I would answer that right now that we are in favor of going down this path of developing a mitigating strategy for these events and subsuming them under the adequate protection umbrella of FLEX or the order. That's kind of the premise going forward with the rulemaking, rather than, you know, let the 50.54(f) letter takes its course and then do a backfit analysis to figure out whether it meets adequate protection.

So, but again the SRM to me has put all that into question. It's not clear to us what the path forward is on the SRM. So we are moving forward. We believe Appendix G is going to be the way to deal with the flood but we don't know for sure.

MEMBER RICCARDELLA: It seems the big issue with the SECY paper was this integrated assessment, and it sounds like you are proposing guidance in how to perform the integrated assessment, right, of the new flooding hazard.

MR. BAUER: Yes. This Appendix G title

is Mitigating Strategies, Flood Hazard Information, Integrated Assessment.

MEMBER SCHULTZ: Next slide.

MR. BAUER: Okay, last slide is on this qualitative factors issues for the SAMGs, and again I think Tim was just getting ready to talk to this about the backfit analysis not necessarily supporting, or the analysis not supporting a backfit of the SAMGs into the regulations.

And it was originally proposed based on qualitative factors that you reach an acceptable backfit consideration, which we believe is not consistent with what the Commission has directed and we're not in favor of using qualitative factors to put SAMGs into the rule.

If the backfit analysis can't support it the way backfit analyses should be done, the industry is willing to make a commitment to continue to develop or use SAMGs with these four elements. We would maintain the strategies. We'd integrate them -- here we go with that word again -- EOPs, and we would have timely incorporation of any Owners' Group revisions to them, and we would establish configuration

controls for them to maintain them.

MR. YOUNG: And recall these are the key attributes from the Statement of Consideration elements of the rule.

MEMBER CORRADINI: So if I can rephrase, you'll do what's in the proposed rule but you don't want to be forced to do it. I retract that. You don't want to be forced to, and you don't want to have it checked. Because if I remember correctly, in the subcommittee meeting I asked this precisely of Tim, which is it wasn't a content issue, it was is it being done, is it being done in some structured manner? And the answer was, at least I remember the answer was yes. So given the fact that you're going to do it anyway, why not have NRC audit it? What am I missing?

MEMBER SCHULTZ: Inspect it.

MEMBER CORRADINI: Inspect it. Excuse me, inspect.

MR. BAUER: All we're saying is that we think we should properly respect the backfit process. We are willing to have it in the rule. But if the backfit process doesn't warrant being in a rule or doesn't pass the test to be in a

rule then we shouldn't manipulate the backfit process to put it in the rule.

MR. YOUNG: It's the basis. It is the basis of the imposition. It's not the imposition, it's not having inspections, it's not doing all these things.

MR. BAUER: Totally in agreement with doing -- what has been aligned out for SAMGs.

CHAIRMAN STETKAR: I asked this at the subcommittee and we're running along on time so I just want to get it on the record. Does the industry have full scope, full scope level 2 PRA capability for all internal and external initiating events where you could quantify the difference in safety benefit with and without SAMGs? And I'm just asking for a yes or a no. If you don't --

MR. YOUNG: You didn't give me "I don't know."

CHAIRMAN STETKAR: If you don't know that's a fair answer. Because I know the staff doesn't, that's why they can't quantify the answer.

MR. WEBSTER: Again we don't have, all plants don't have full scope.

CHAIRMAN STETKAR: Let us know who you are.

MR. WEBSTER: I'm Bill Webster with Dominion. I'm sorry.

MR. YOUNG: And Bill is the --

MR. WEBSTER: I'm the PRA supervisor for Dominion. So we don't have full scope level 2 PRAs that we could formally do that calculation.

CHAIRMAN STETKAR: That's in my mind a bit of the bind on the inability of anyone to quantify the benefits of SAMGs because nobody has the calculator to do that. Regardless of whether you say the onus is on the staff or the onus is on the industry to show that they don't provide, nobody has that calculator. So there isn't that ability to do that kind of real quantitative comparison. The analysis that the staff made reference to is inadequate to draw any conclusion.

MEMBER SCHULTZ: Any other questions for industry? We'll make a quick shot back to the staff.

MR. YOUNG: Let me just thank you for allowing us to come up and --

MEMBER SCHULTZ: Well, thank you.

Tim, speaking of backfit considerations, you're up.

MR. REED: This is a segue of sorts. This is backfit. As you've heard, industry has some serious concerns about the backfit justification. I certainly understand those concerns. It was as I mentioned here in the slide it's got two aspects to it. We'll talk about it here in a slide.

But first of all, before you get into the nuts and bolts of that I think you can look at all the requirements in this regulation kind of in two bins. The first bin is what's already going into place, and it's either going into place because of an order or it's going into place for a broad implementation of an order or it's going into place because voluntarily the industry's doing it.

And so you see those items listed there. So everything for EA-12-049 and obviously EA-12-051 are already in place, therefore they're not backfits so have already been imposed by order. Multi-source dose assessments being done voluntarily, okay. So we expect that they'll be no impact, but technically that is in your

requirements a backfit so we have to address that.

Technology-neutral ERDS is really a cleanup. In my view that's simply administrative. The staffing and communications has been, I don't mention it there, but I think it goes hand in hand with a mitigation response for a site.

So I view that as integral to a successful mitigation of a site-wide event, so I view that as part, really, of the order even though they came out in two separate actions. So I personally view it that way. I think that's the right way to see it in backfit space.

So that leaves us simplifying this down to the SAMGs and everything that supports the SAMGs and a forward fitted, as the slang amusing here, it's a backfit. Forward fitting means it's not being opposed by any current licensee for the design features requirements that you heard earlier in which Jim Shea has a non-concurrence on.

So that's down the road new design type of thing, and everything else I'm looking at from a current licensee's imposition thing and that's

the SAMGs. So this is basically trying to simplify what can be fairly complex given all these regulations in there how the backfit sorts out.

So, and I've got two parts of it and I've qualitative arguments for it that I've tried to put together I think are very strong qualitative arguments. I do recognize that unfortunately I wasn't able to reflect the qualitative factors SRM. It came out too late in the process, but that just came out here in March and certainly I wasn't aware when a lot of this was drafted. But I do understand the concerns from external stakeholders in that regard.

But it's very clear that -- I don't think anybody would argue about this at all -- that SAMGs are a very direct link in terms of defense in depth. You can argue about whether those are warranted even though if they are defense in depth, but clearly they are. They obviously go directly to the use of containment when containment matters when you have fission products and in trying to make maximal, best use of that containment using your equipment, your people, ensure that that maintains under human

control.

You don't want to lose the integrity of that containment if at all possible, and you want to basically use that containment to hold up and minimize releases to the maximum extent you can. That's the whole point there with the containment.

And SAMGs also, it was talked about a little bit earlier about the instrumentation and everything. As those folks are going on they're trying to get the best understanding of this, prevention of this event, and that can provide valuable information to the emergency response organization in terms of the fission product barrier integrity or the loss of it or the impending loss of it, and so there's at least an opportunity there that there could be great information coming out of this that could inform those decisions both for onsite and offsite protective actions.

And that goes to another big piece of the infrastructure of the NRC's regulations and EP. So the arguments that I think you folks are probably well aware of, I've made two pretty strong qualitative arguments in terms of defense

in depth. One related directly to containment, one related to EP. I think the committee liked those arguments. However, I think it's very important for the Commission and not only in this regulatory action, in all regulatory actions, to provide them as much as possible risk insights that I checked.

And so in that regard I tried to look at everything I could, and I do fully understand the limitations of the available information out there, but I nonetheless tried to, I think I was fairly careful when I went back and looked, I think I'm pretty careful about how I've caveated the limitations of that information. I looked at what's available in terms of risk insights.

There is no PRA out there available today unfortunately that looks at SAMGs. You know, as John said and probably was asking before, we unfortunately don't have it, but we do have information that in my view is very, very important. Because it shows, as the committee's aware, risk levels that are not just below the QHOs, they're way below the QHOs.

And in fact I took to heart some of the, and I'm probably going to get some more feedback

here in a minute, what we got to the subcommittee, and I went back and looked at the state of the art reactor consequence study and it says the same thing even stronger actually. And it by the way modeled 50.54(hh)(2).

And there may be some challenges to that modeling, but I don't think there will be any challenges today given what's happening on the mitigation strategies order, because the mitigation strategy capability going into place today, okay, is site-wide, is indefinite, is engineered with connections in plug and play and it's been engineered the whole way through.

And so now I think the mitigation capability is very real and it's truly an additional capability and I think it's a great effort from everybody involved, but I think it does show a pretty substantial benefit in core damage reduction in these analyses.

Now I do recognize there's limitations. I do recognize they weren't geared to look at SAMGs, and I fully understand the human reliability aspect wasn't done that well. But those risk insights, I think, are still valuable and I think that I owe it to the Commission to

informing their decision, and this is their decision. Everybody should understand that it's the Commission's decision on how much weight they want to put on the qualitative argument versus how much they want to look at these risk insights. And that's kind of what that SRM and qualitative factor says.

So what I'm trying to do is fully inform them so they can make the best decision possible. And that's the spirit that this was done in, and I think providing this package to them in that way and showing them SAMGs in the rulemaking enables them to see how it would look, and if they need to extract it out it's certainly easier to take out than to put in, you know, in terms of envisioning how it would look.

So that's how it's going forward. Understand the feedback from the industry. That voluntary commitment is certainly, at least the ideas put on their slide are much more detailed commitment to SAMGs than what was in place today from the 1990s for folks that don't know that. So it does hit the main elements of our proposed regulation as was just mentioned.

So I'll come to a full stop because I

imagine some folks want to comment. If not, we can keep going. John, you're still looking down. I don't know if –

MEMBER SCHULTZ: We can come back to this if we have questions. Go ahead and do the reg guidance.

MR. REED: Okay.

So going into draft regulatory guidance we have is two sets, three sets of regulatory guidance. DG-1301, which is the draft guide that would endorse the mitigation strategies guidance and we're hoping to get NEI 12-06 rev 1. The current guidance that's endorsed for the mitigation strategies order was rev 0.

So what we're doing is working it up to rev 1 and that way it would fold in all basically the lessons learned and feedback from implementation of the orders. And it's a pretty substantial update to that and we hope to get that fairly soon.

And we have I think as you've heard some challenges in at least two areas. Hopefully we have, we'll be able to get an appendix on the reevaluated hazards and how that should be considered within the mitigation strategies and

reasonable protection. and it sounds like maybe even to go into alternative targeted strategies as we just presented.

And then we have a larger challenge, I think, on how to address seismic at least in the near term. You know, I know there's seismic PRAs down the road and so I think that's as mentioned there that's a whole different animal in my view than flooding. And so we'll have to get creative on how we do that, because right now, as was mentioned actually in the previous presentation, without that guidance we'd be very challenged to meet our CER, Cumulative Effects of Regulation process in putting the guidance out with the rules. So we'll have to look and see what we can do.

And second guidelines, DG-1317, there's no substantive changes to the previous endorsement of the guidance for EA-12-051, it's just now at a reg guide format. That's not too interesting, I'm sure, for this committee's results.

The third one, I'm sure, probably is. DG-1319, the Integrated Response Capabilities for Beyond-Design-Basis Events. This is looking at

three different NEI guidelines. First, 12-01 which was already endorsed and there are no substantive changes to that. That's staffing and communications capability. That remains basically intact, okay, so there's no change from what was found acceptable in response to this 50.54(f) letter. But the next two are new, 13-06 and 14-01, we can talk about those. I believe I have a slide coming up here in a second.

So DG-1301, I only do a not very good facsimile of Eric Bowman. Eric's the guy, obviously he wasn't able to be here today. But this is, I mentioned, it's unfortunately not in a final form. We're waiting to get to rev 1, where currently we have a draft © of this version to get to rev 1.

And as I mentioned it incorporates lessons learned feedback from EA-12-049. And we have to figure out, it's been noted here, at what to do with this reevaluated hazard in the SRM, how to fold that guidance in as appendices. So that I think is a substantial challenge that we need to address, and I think we'll have to see what we can do with meeting with the committee here in future meetings and see what we can do in

that regard.

Then we have Appendix A to 1301 which goes to new reactor design, and I'll turn it over to the folks here from NRO.

MR. ASHLEY: Thanks. My name's Clint Ashley and I work in the office of New Reactors. I was a member of a team that worked to put together some of this new reactor guidance in the proposed rule, and there's other members in the audience if there's questions that should arise.

Current agency endorsed guidance has focused on the operating fleet and reflects the fact that operating reactors are constrained by existing structure systems and components as well as plant layouts.

However, without such constraints new reactor applicant have an opportunity to incorporate into the plant design those design features that enhance mitigating strategies to maintain and restore key safety functions. Such design features should reduce and simplify the manual actions necessary to maintain these safety functions and allow more time to assess plant conditions and prolong the use of installed plant equipment.

This approach as John mentioned earlier is consistent with the advanced reactor policy statement in which the Commission previously encouraged vendors to include these design features into the design. So on this Draft Guide 1301 Appendix A, it contains guidance that provides applicant for new reactor power plants with an acceptable method to meet the proposed rule, and this slide highlights guidance related to coping duration and human actions which are the areas that are not addressed by NEI 12-06 due to the fact that paragraph (d) is a fairly recent addition to the proposed rule and is obviously limited to new reactor applicants.

So to enhance coping durations, the design features should increase the amount of time that safety functions can be maintained early in an event before there's a need to augment with plant equipment, excuse me, augment the plant equipment with onsite portable equipment. Enhancing coping duration provides operators time to plan and implement the onsite portable equipment and mitigation strategy for the longer term coping.

So for enhanced coping durations the

staff looked at two things. Basically there's two time frames that we define, one is the 24 hours and the other one is 72 hours. The 24 hours is how we define enhanced coping durations for the initial phase. The staff's reasoning behind selecting that period of time was based on information associated by reviewing new designs as well as the existing fleet. For example, the AP 1000 and the ESBWR, that initial coping is for 72 hours. For the ABWR design it can cope out to, I believe, 36 hours. And in general for a lot of the operating reactors the coping duration for the initial phase is at about eight hours or less.

CHAIRMAN STETKAR: You had to say it, I wasn't going to because of the time, ABWR is 36 hours if and only if the operators de-energize the control room to extend the batteries, relocate to a place where they don't normally live and try to do things from that location. That to me is not minimizing operator actions.

We need to keep on with the time. I just wanted to get that on the record.

MR. MCKIRGAN: Thank you. Yes, and certainly --

CHAIRMAN STETKAR: That's the only way the ABWR meets 36 hours.

MR. MCKIRGAN: And that is part of the motivation of the staff in offering this provision paragraph (d). We think new reactor vendors have an opportunity to enhance those so that those kinds of actions aren't necessary.

CHAIRMAN STETKAR: Thank you.

MR. ASHLEY: We also believe that specifying coping durations in guidance would actually contribute to the regulatory stability and predictability for new reactors with respect to the proposed rule.

We already talked about, 72 hours is basically when you would expect offsite resources to come in so that transition period would take you from at least 24 hours to out to 72 hours. And the 72 hours again is consistent where we see a lot of the, not just new reactor designs but even the op fleet can easily go out to 72 hours in many instances before they need to have the outside resources applied.

The guidance for new reactors also has in the initial response phase we permit use of an installed AC power engineered alternative and we

call this a supplemental AC source. This source has to be protected from the external hazards such as flood and seismic. Basis for eight hours is to be consistent with the near-term task force report.

And this supplemental AC source is independent and diverse from the emergency AC source. Permanently installed and normally disconnected from the electrical bus and designed such that only minimal operator action is necessary to place this in service.

With respect to minimized reliance on human actions, the proposed requirement is really modeled after the aircraft impact assessment, and so we adopt a similar concept here. We view greater reliance on design features that include well thought out human/machine interface would reduce reliance and simplify the manual actions necessary to maintain and restore key safety functions. And further reducing reliance on human actions would also reduce the potential for human failures during stressful, adverse conditions.

So for the initial response we look at minimal actions at limited protected locations

with monitoring, control and coordination from the main control room or, if needed, at some other location that is designed for that purpose.

Following the initial phase, again we look at this as just actions should be reasonable considering the conditions following the event. That's the end of the information I had. Questions?

MEMBER SCHULTZ: Thank you, Clint. After you, Tim.

MR. REED: Okay. Going to DG-1319, the third draft guidance documents I mentioned, it's carried forward, the guidance from NEI 12-01 that we said going to the staffing analysis and communications capabilities with no substantive changes. It's endorsing NEI 13-06, and that document if you drove down to it contains guidance on multi-source term dose assessment. It's got training and drills and exercises guidance in there as well as PPE facilities and equipment guidance in there.

And then finally it also addresses or endorses NEI 14-01 which is addressing basically integration but also SAMGs. It talks about SAMGs but not the actual detailed review of Owners'

Group or plant-specific SAMGs. Basically more first principles on how they developed the SAMGs, how to maintain them, contain them and control them, configuration and that kind of thing. In line basically with our regulatory structure though, and it also addresses command and control. So those are the three guidance documents that are the three NEI documents that are endorsed through DG-1319.

So I get to the Status and Path Forward and we can see where we go from here. As mentioned at the very beginning of the meeting, we are very far and deep into concurrence. Most of the offices have concurred with the exception of work in the Office of General Counsel, and then finally we'll go through the NRR.

So we're near the end here of concurrence hopefully, and our goal is to get it to the EDO's office at the end of next week, which is extremely fast given what we have left, and then get it two weeks later to the Commission. We as part of our CR process want to issue all the draft guidance with the proposed rule. I think we have some challenges there to work on that and that's certainly recognizing

that we've got ongoing work on 1301.

It's been talked about several times today, and we, at the subcommittee, we've offered to meet with the subcommittee, the ACRS in general as much as you folks want to meet with us as best as we can, and try to, you know, interact and get the committee's feedback as we go forward.

Now as the process itself is about getting the guidance out with the proposed rules, so you have to try to guess on how long it's going to take the Commission to do its thing and deliberate on the facts and give us an SRM. And I know there's a Commission briefing set for July 9th. I know that because I probably have to be at that at the table. And so that I think realistically we're looking at maybe end of July or even August by the time this would go to the Federal Register.

So I think that's the real deadline for guidance, and even then I think that's really ambitious on where we're at on some of the guidance. We're going to have to figure out creatively what we can do there and we can work with ACRS and what you folks want to do and

meeting with us best we can.

MEMBER SCHULTZ: Our approach with regard to the draft guides would be to move ahead as quickly as we can to have a Fukushima Subcommittee meeting on this soon. We're not putting any conditions out beyond that but it's not only aimed at Draft Guide 1301 but the draft guides as a package.

MR. REED: Okay.

MEMBER SCHULTZ: So we'll address the priorities there and the content to that meeting later.

MR. REED: I think if I was going to try to time that meeting I would try to understand where we might expect to get the flooding appendix in NEI. If that's reasonably in the short term and you think we can respond to that, Eric can respond to that, that might inform, that would be a really good point of then meeting with the ACRS. It would be a lot more information.

CHAIRMAN STETKAR: Okay, let me try something here because we have a hard time constraint on the members here. We can work out details of subcommittee meetings off line.

MR. REED: Okay. That's really all I

had.

MEMBER SCHULTZ: Questions for the staff? Comments related to the presentation by the staff? From the committee? Not hearing any, I will ask if there are members of the public in the room that would like to make a statement to the committee.

And while we're seeing whether that's the case we're going to open up the phone line. If you'd like to make a statement please come to this microphone. Announce your name and make your comment to the committee.

MR. DOLLEY: Thank you. My name is Steven Dolley. I'm a reporter with Platts. I edit "Inside NRC." And it's actually a question rather than a comment. If that's not --

MEMBER SCHULTZ: We'll only take comments. You could ask the question --

MR. DOLLEY: Okay, my comment is, I sure would like to know if Jim Shea's non-concurrence has been made public and how it's addressed.

MR. REED: It has not been made public yet, but Jim has asked for it to be made public and it will be made public.

MEMBER SCHULTZ: All right. Is the

phone line open? If you're on the phone line please let us know that you're there by saying hello. Is anyone on the phone line? We believe it's open but I don't hear it exactly. Hold on for a moment and we'll see if we can validate our -- all right, I think I hear it.

If any member of the public is present could you please say hello? Is there anyone, a member of the public who would like to make comment? If so, please state your name and make a comment.

Hearing no response I'll consider the public comment period closed and turn the meeting back over to you, John.

CHAIRMAN STETKAR: Thank you very much. And again thanks for the staff and the industry. This is a really important effort. We're running a little bit long as well, well justified.

We will recess for lunch.

(Whereupon, the above-entitled matter went off the record at 12:57 p.m.)

U.S.NRC

UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment

GEH Simplified Stability Solution (GS3) Background

ACRS Meeting

April 9, 2015

Ashley S. Guzzetta

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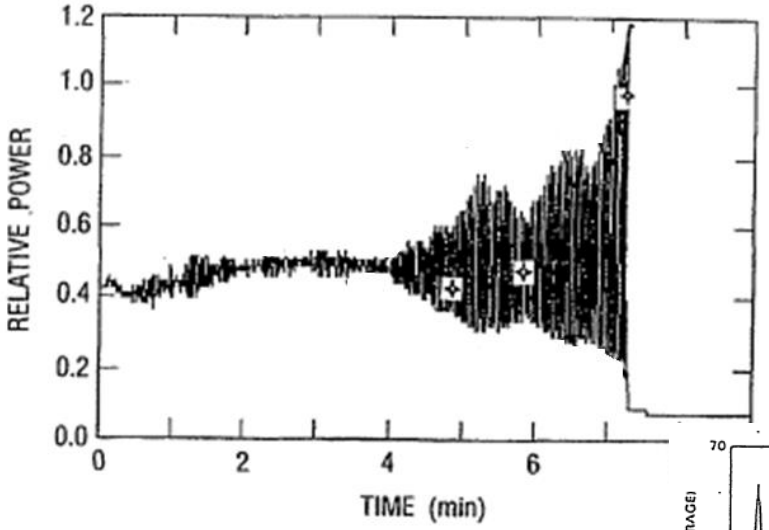
Reactor Systems Branch

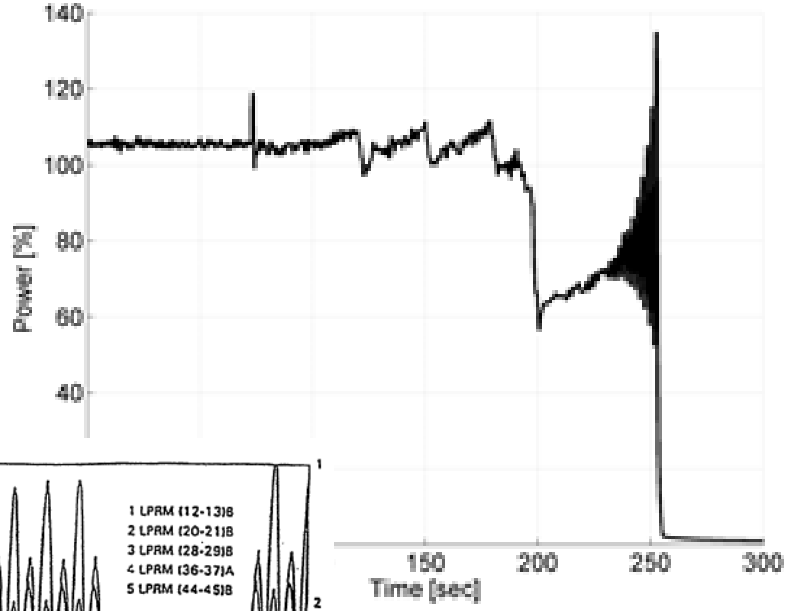
Division of Safety Systems

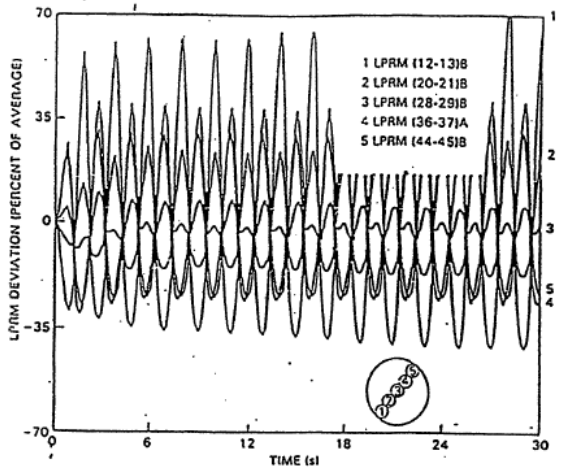
Dr. Jose March-Leuba

Oak Ridge National Laboratory

Instabilities are Real!

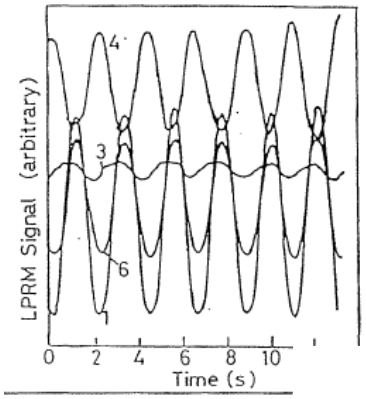


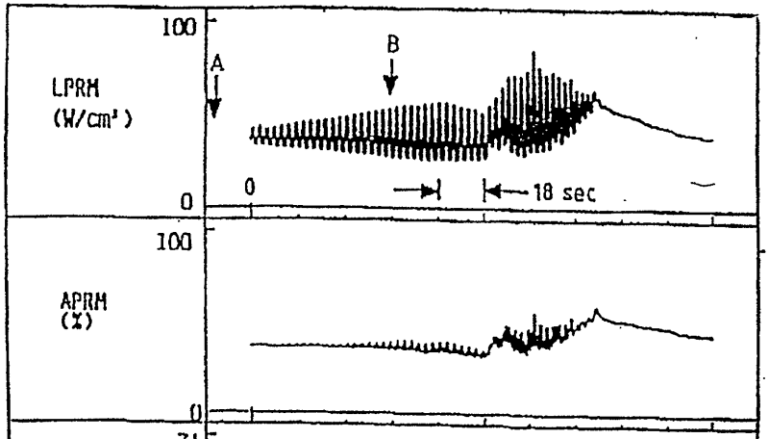


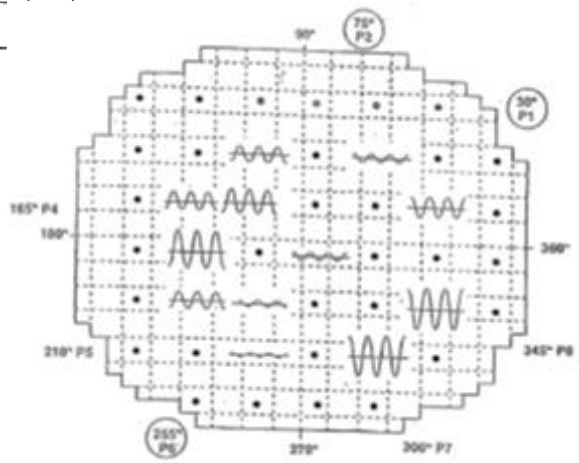


- Reactor must scram!

Out-of-Phase Oscillations







- APRM High Power Scram may not provide protection for all scenarios
  - Long Term Solutions (LTS) were developed

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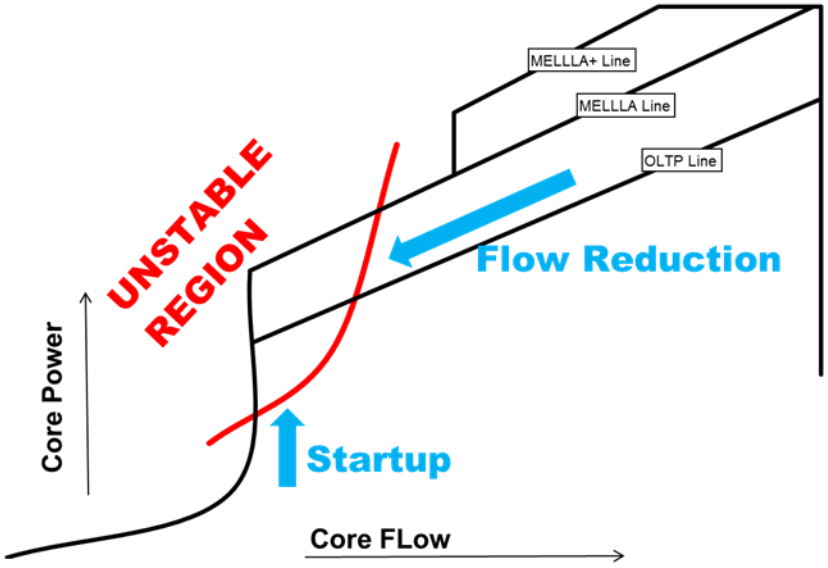
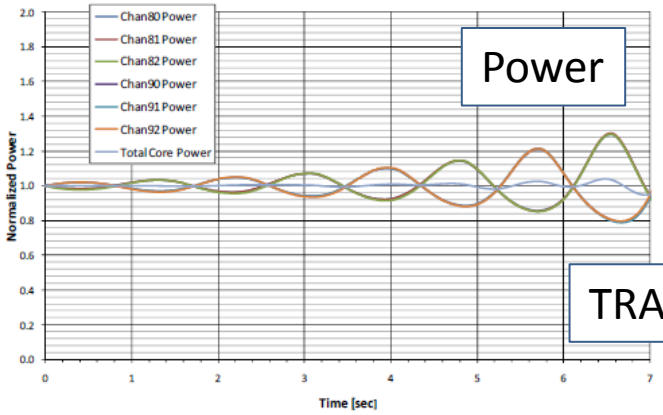
Instability Scenarios



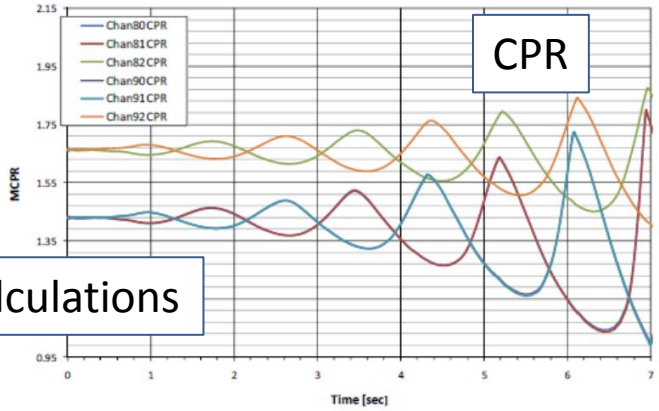
- Startup
  - Slow rod motion
  - Low amplitude oscillations
- Flow Reduction
  - Fast entry to Instability Region
  - Oscillations may be large

- 2RPT is analyzed to demonstrate acceptability of LTS implementations

DIVOM Methodology

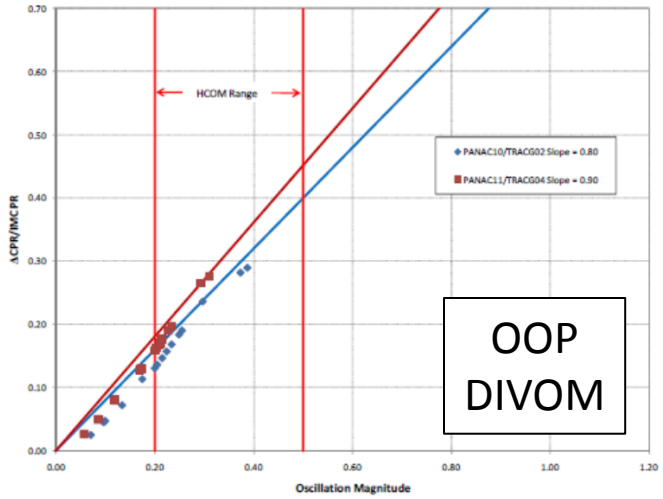


Power

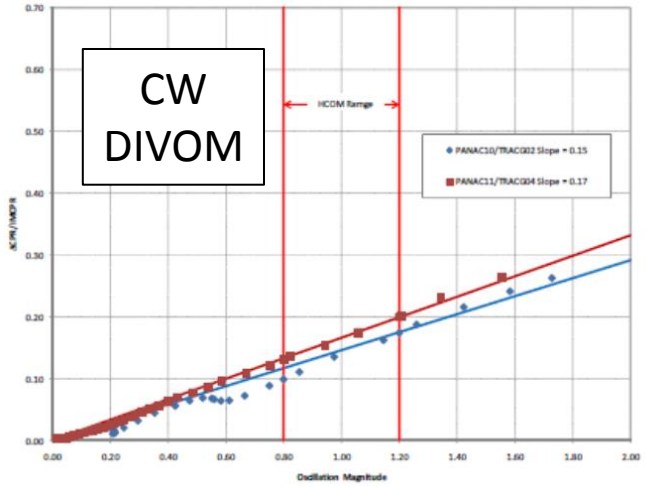


CPR

TRACG Calculations

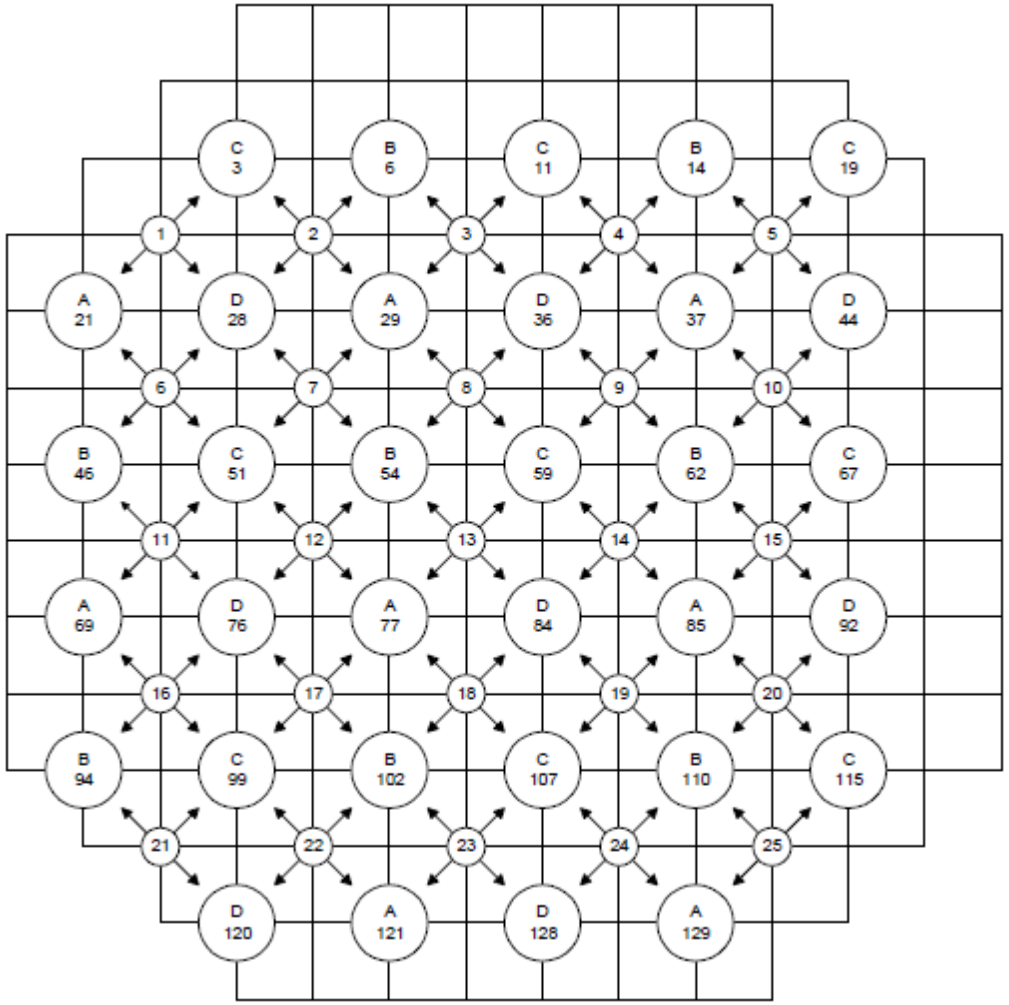


OOP DIVOM



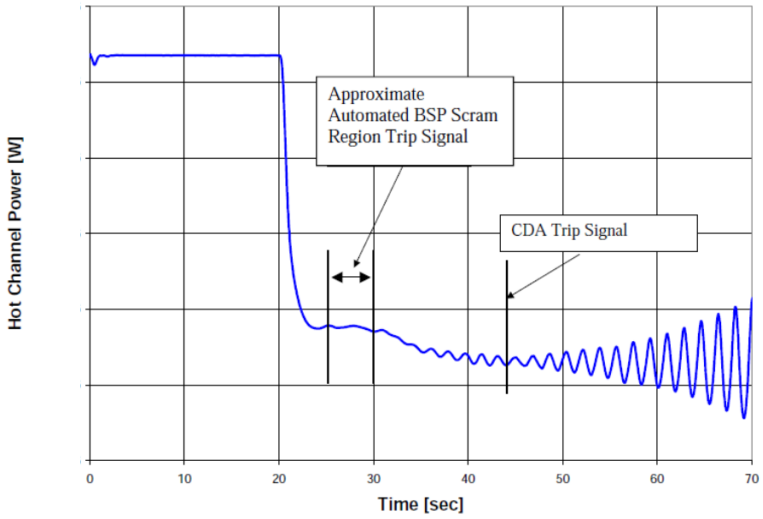
CW DIVOM

"HCOM" Methodology

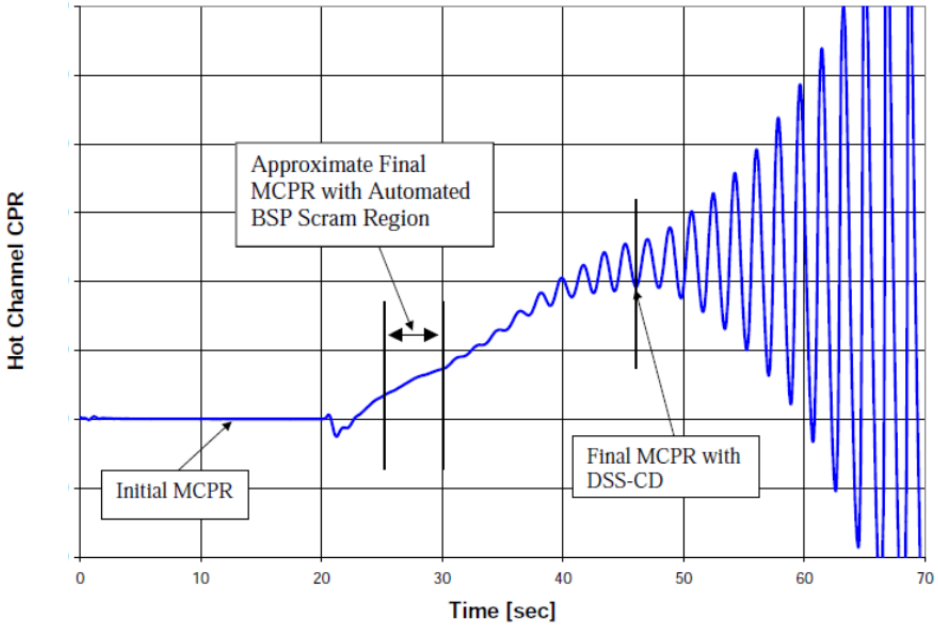


- OPRM safety channel is a combination of multiple LPRMs
- If OPRM detects scram at 12% amplitude, peak LPRM may oscillate by 20%, 30%, 40% …

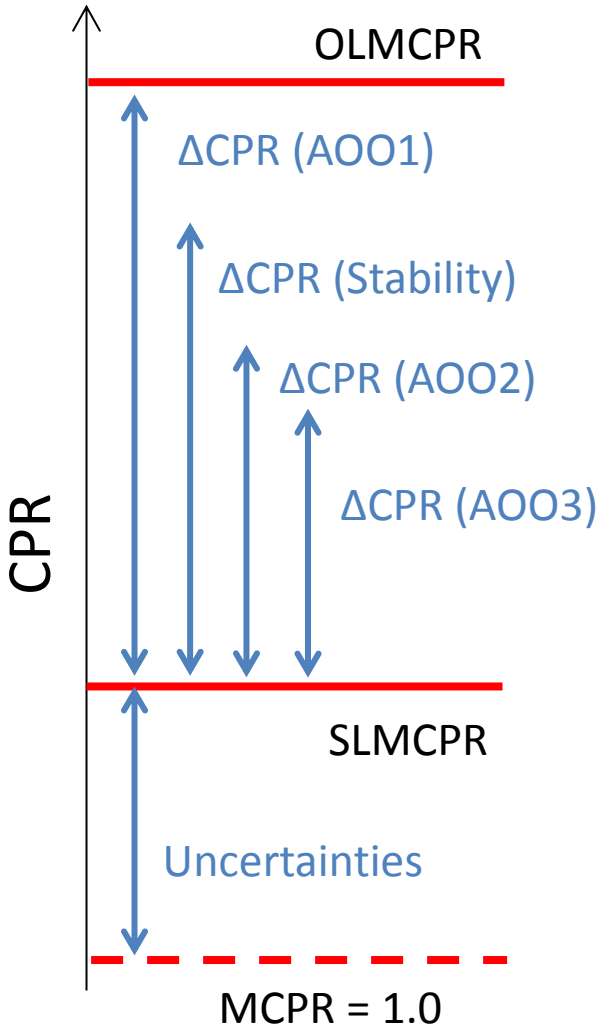
Typical 2RPT



- CPR at time of scram can be larger than at initial conditions



Safety and Operating Limits



- OLMCPR is defined by the AOO event with largest impact
- With GS3 Methodology, Instability is no longer the limiting AOO for any plant
- Typical ΔCPR numbers are
  - 0.26 for AOO
  - 0.13 for stability

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Summary

- Current D&S LTS methodology is conservative, but unnecessarily complex, and costly
- Confirmatory calculations show that “real” transient has plenty of margin
- GS3 attempts to make the methodology more realistic while maintaining conservative margin
- Reduces spurious trips by demonstrating effectiveness of best-estimate margins

Industry Perspective on Draft Proposed Mitigation of Beyond Design Basis (BDB) Events Rule

Scott Bauer
Sr. Project Manager,
NEI

Roy Linthicum
Exelon Nuclear
Chairman,
PWROG RMSC

David Young
Sr. Project Manager,
NEI

April 9, 2015 • ACRS Meeting

Mitigating Strategies

- For BDB external events, the rule should reflect requirements for:
  - Maintaining the capability to implement FLEX strategies, AND, if needed,
  - Developing and maintaining another mitigating strategy if new/updated hazard information indicates that implementation of FLEX strategies may not be successful
    - Increased flood level

Mitigating Strategies

- Hazard-specific strategies could be:
  - **Alternate Mitigating Strategy** that protects all irradiated fuel in the core and spent fuel pool, and the containment function
  - **Targeted Hazard Mitigation Strategy** that protects all irradiated fuel in the core and spent fuel pool, but not the containment function
- **Key Difference** - These strategies should be based on a hazard-specific analysis and not the assumptions used in FLEX strategies (e.g., an installed AC power source or the ultimate heat sink may be available)

Reevaluated Hazards – (b)(1)

(b) *Integrated response capability*. Each applicant or licensee shall develop, implement, and maintain an integrated response capability that includes:

(1) Mitigation Strategies for Beyond-Design-Basis External Events.

(i) Strategies and guidelines to mitigate beyond-design-basis external events from natural phenomena that result in an extended loss of all ac power concurrent with a loss of normal access to the ultimate heat sink. These strategies and guidelines must be capable of being implemented site-wide and must include maintaining or restoring core cooling, containment, and spent fuel pool cooling capabilities.

(ii) Strategies and guidelines to mitigate beyond-design-basis external events from natural phenomena that results in a damage state determined by a site-specific analysis, if the analysis indicates that implementation of the strategies and guidelines in paragraph (b)(1)(i) will not be effective. These strategies and guidelines must be capable of being implemented site-wide and must include maintaining or restoring core cooling and spent fuel pool cooling, and, where feasible, containment capabilities.

(iii) The acquisition and use of offsite assistance and resources to support the functions required by paragraph (b)(1)(i) and (b)(1) (ii) of this section.

Appendix G to NEI 12-06

- Will contain guidance for performing an integrated assessment of the mitigating strategies for new/updated flood hazard information
- At this time, does not contain guidance for addressing new/updated seismic hazard information
  - Need staff engagement to determine process
  - May impact timeline or content of rule package

Qualitative Factors Requiring SAMGs

- Use of qualitative factors to justify imposing SAMG requirements is not in accordance with Commission direction (SRM-SECY-14-0087)
- Industry supports submittal of a docketed commitment by each site to address SAMGs
  - Maintain SAMG strategies
  - Integration with EOPs and other guidelines sets
  - Timely incorporation of Owners Group revisions
  - Establishment of configuration controls

Plant Indications During Severe Accidents

- Owners Groups provide guidance to determine or validate indications using available information
- Use alternate instrumentation for a parameter value
  - Look at related or linked parameters (e.g., P and T)
- Assess parameter trends and changes in trends
- Determine indications/trends not directly provided by instrumentation (e.g. use of calculational aids)
- Training material will review the importance of validating instrument responses

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Mitigation of Beyond-Design-Basis Events (MBDBE) Proposed Rulemaking

Advisory Committee on Reactor Safeguards

Full Committee

April 9, 2015

Background

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- Efficiency gains through consolidation
- Scope of proposed rulemaking as it relates to originating Near-Term Task Force (NTTF) recommendations:
  - All of recommendations 4, 7, and 8
  - All of 9.1, 9.2. and 9.3 – except long term Emergency Response Data System (ERDS)
  - 10.2 (command and control/decision maker qualifications) and 11.1 (delivery of equipment to site - phase 3 portion of Order EA-12-049)
  - Includes NTTF 9.4 (ERDS modernization)
- In terms of post-Fukushima regulatory actions already underway:
  - Makes generically-applicable Order EA-12-049 and Order EA-12-051
  - Addresses staffing and communications from NTTF 9.3 (10 CFR 50.54(f) request)
  - Addresses re-evaluated hazards from NTTF 2.1 (10 CFR 50.54(f) request)

Proposed Rule Language

Paragraph (a) - Applicability

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- Applicability
  - Current operating reactors
  - New reactors
  - Decommissioning reactors
- Requirements apply to both current and new reactor licensees and applicants
  - Design features requirements in proposed § 50.155(d) are for new reactor plant designs, and are in addition to the remainder of the requirements
- Decommissioning provisions:
  - Once fuel is permanently removed from the reactor - no reactor or primary containment requirements
  - Once decay heat is sufficiently low versus SFP heat up/boil off to provide ample time: then only remaining mitigation is § 50.155(b)(2)
  - Once irradiated fuel is removed from the spent fuel pool - all requirements cease

Proposed Rule Language
Paragraph (b) – Integrated Response

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- Integrated Response Capability
  - Beyond-design-basis external event mitigation
    - Would make Order EA-12-049 generically applicable
    - Formerly referred to as SBOMS (industry's "FLEX" program)
  - Extensive Damage Mitigation Guidelines (EDMGs)
    - Would move § 50.54(hh)(2) requirements to this rule
    - No substantive changes to requirements
  - Severe Accident Management Guidelines (SAMGs)
    - Currently voluntary industry initiative
    - Regulation would require SAMGs
      - Inspection under ROP only - no licensing review.
    - No additional equipment requirements

Proposed Rule Language

Paragraph (b) – Integrated Response

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- Integrate with Emergency Operating Procedures(EOPs)
  - Structured to not impact previous regulatory efforts on EOPs
- Supporting staffing and command and control
  - Both staffing and command and control should be in place after Order EA-12-049 implementation
  - Recognizes challenge of a site-wide event that could lead to core damage and involve offsite assistance

Proposed Rule Language

Paragraph (d) – New Reactor Requirements

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- New reactor design requirements:
  - Only applies to applicants listed in paragraph § 50.155(a)(4)
  - Would require that design features be incorporated into new reactor plant designs that enhance coping durations and minimize reliance on human actions for an extended loss of all ac power concurrent with either a loss of normal access to the ultimate heat sink, or, for passive reactor designs, a loss of normal access to the normal heat sink.
- Intent:
  - Require certain elements of the Commission's advanced reactor policy statement for new reactor designs during ELAP/LUHS
    - "…longer time constants and sufficient instrumentation to allow for more diagnosis and management before reaching safety systems challenge or exposure of vital equipment to adverse conditions."
    - "simplified safety systems that, where possible, reduce required operator actions"
  - Applicants would consider the effects of an ELAP/LUHS early in the design process and incorporate design features that provide enhanced capabilities to address these events

Proposed Rule Language

Paragraph (c) – Equipment Requirements
Paragraph (e) – Training Requirements

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- Equipment Requirements
  - Would make Order EA-12-049 equipment requirements generically applicable
  - Would make Order EA-12-051 spent fuel pool level instrumentation requirements generically applicable
  - § 50.155 (c)(2) revised to reflect COMSECY-14-0037:
    - Mitigation strategies equipment required by paragraph (b)(1) must be reasonably protected from the effects of natural phenomena that are the more severe of: (1) the design basis of the facility; or (2) the licensee's reevaluated hazards, stemming from the March 12, 2012, NRC letter issued under § 50.54(f), as verified by the NRC's assessment issued by [EFFECTIVE DATE OF THE RULE].
- Training
  - Training of personnel for activities not already addressed
  - Systems approach to training
  - Expect most training already addressed as part of EOPs and Order EA-12-049 implementation
  - New training should be in the SAMG area

Proposed Rule Language

Paragraph (f) Drills and Exercises
Paragraph (g) – Change Control

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- Drills provide assurance that guideline sets are integrated and can be used
  - Initial drill(s) to show use and transitions
  - Follow-on drill(s) to provide assurance of continuing capability
  - Complex drill schedule: Initial drill within 2 refueling outages (RFs) and follow-on in 8 calendar years
  - Current operating licensees/holder of combined license (COL) after 52.103(g) finding:
    - 1st drill within 2 RFs – after that 8 year period
  - Applicants for a part 50 operating license (OL) or holder of COL before 52.103(g) finding:
    - Demonstrate use and transitions – initial drill(s)
    - Subsequent drills - 8 year period
- MBDBE Change Control
  - Facility changes can impact multiple regulatory areas; all change controls must be applied
  - No threshold criterion; must comply with requirements

Proposed Rule Language

Appendix E, Application, Implementation

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- New Appendix E requirements
  - Multi-source term requirements are incorporated directly into current Appendix E
  - New Section VII requirement for staffing and communications
  - Technology-neutral ERDS
- Application requirements
  - Applications for new reactors
- Implementation: Will use the Cumulative Effects of Regulation (CER) process

Backfit Considerations

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- The MBDBE rule has different supporting backfit bases:
  - Proposed rule requirements are severable
  - Order EA-12-049 and Order EA-12-051 requirements are <u>not</u> backfits (i.e., already imposed by orders)
  - All other requirements need justification under Part 50 backfitting provisions (operating reactors) and Part 52 issue finality provisions (new reactors) :
    - Items supporting Order EA-12-049 are technically backfits without impact
    - SAMGs and supporting requirements (drills and training that involve SAMGs)
    - Multi-source dose assessment (voluntarily implemented): Is a backfit but should not cause additional impact
    - New reactors requirements are designed to be “forward fitted”
    - Technology-neutral Emergency Response Data System (ERDS) remove technology reference, aligns with current practice, not a backfit

SAMGs Backfit

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- Qualitative basis for imposing SAMG requirements
  - Guideline set used by operators and decision-makers following onset of core damage
  - SAMGs support making optimal decisions concerning containment
  - SAMGs support informing the emergency response organization with regard to protective actions (e.g., fission product barrier integrity)
  - The value of SAMGs, pre-planned guidelines for best use of all available resources to mitigate the accident

- Quantitative basis informed by Containment Protection and Release Reduction effort

Draft Regulatory Guidance

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- DG-1301 “Flexible Mitigation Strategies for Beyond-Design-Basis Events”
  - Current draft guidance would endorse NEI 12-06 rev. 1 with clarifications
  - NEI is revising NEI 12-06 rev. 0 (to produce rev. 1):
    - To reflect lessons-learned from implementation of Order EA-12-049
    - To address re-evaluated hazards
  - Includes guidance for new reactor designs to meet proposed § 50.155(d)
- DG-1317 “Wide-Range Spent Fuel Pool Level Instrumentation”
  - Would endorse NEI 12-02 (Previously endorsed for Order EA-12-051)
- DG-1319 “Integrated Response Capabilities for Beyond-Design-Basis Events”
  - Would endorse NEI 12-01 (Previously endorsed for RFI), NEI 13-06, and NEI 14-01

DG-1301

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- Preliminary Draft
- NEI 12-06, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, Revision 1, Draft C, is basis
- Incorporates lessons learned in Order EA-12-049 implementation (alternative approaches, generic items, etc.)
- Work remaining includes:
  - Receipt of SRM-COMSECY-14-0037 to support development of NEI 12-06 Appendices for Seismic and Flooding Re-evaluations

DG-1301 Appendix A
(For New Reactor Designs)

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- *Enhance coping durations*
  - Initially cope with installed SSCs at least 24 hours
    - After 8 hours, use of supplemental ac permissible
  - Then, cope at least 72 hours, using on-site equipment, before off-site resources are obtained

- *Minimize reliance on human actions*
  - Initially, minimal actions at limited and protected locations; monitoring, control, and coordination from the MCR or designed in location
  - Following the early phase, actions should be reasonable considering anticipated site conditions following the event

DG-1319

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- NEI 12-01, “Guidelines for Assessing Beyond Design Basis Accident Response Staffing and Communications Capabilities”
  - Accident response staffing
  - Communications systems
- NEI 13-06, “Enhancement to Emergency Response Capabilities for Beyond Design Basis Events and Severe Accidents”
  - Multi-unit dose assessment
  - Training
  - Drills and exercises
  - EP facilities and equipment
- NEI 14-01, “Emergency Response Procedures and Guidelines for Beyond Design Basis Events and Severe Accidents”
  - SAMGs - No detailed review of Owners Group or plant-specific SAMGs
  - Command and control
  - Procedure integration

Status and Path Forward

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- Proposed rule package is in concurrence:
  - Due to EDO on April 16, 2015 and Commission on April 30, 2015
  - Draft guidance should be issued with proposed rule in summer 2015
  - Recognize the ongoing work on DG-1301 and can meet with the ACRS prior to July or during public comment period if the Committee desires.

- Future ACRS interactions
  - If desired - can meet on DG-1301
  - Final rulemaking meetings – TBD