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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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624TH MEETING

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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OPEN SESSION

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THURSDAY

MAY 7, 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, Vice Chairman

MICHAEL CORRADINI, Member-at-Large

RONALD G. BALLINGER, Member

SANJOY BANERJEE, Member

CHARLES H. BROWN, JR. Member

DANA A. POWERS, Member

HAROLD B. RAY, Member

JOY REMPE, Member

PETER RICCARDELLA, Member

MICHAEL T. RYAN, Member

STEPHEN P. SCHULTZ, Member

GORDON R. SKILLMAN, Member *

DESIGNATED FEDERAL OFFICIAL:

WEIDONG WANG

ALSO PRESENT:

GREG BROADBENT, Entergy

BRYAN FORD, Entergy

CHRISTOPHER JACKSON, NRC

MEENA KHANNA, NRC

RICKY LIDDELL, Entergy

BRUCE LIN, NRC

JOSE MARCH-LEUBA, ORNL

JAMES NADEAU, Entergy

JERRY PURCIARELLO, NRC

BRIAN THOMAS, NRC

ALAN WANG, NRC

GEORGE WILSON, NRC

*Present via telephone

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

(8:34 a.m.)

CHAIR STETKAR: The meeting will now come to order. This is the first day of the 624th meeting of the Advisory Committee on Reactor Safeguards. Here at today's meeting the committee will discuss the following -- Grand Gulf MELLLA+ License Amendment; Regulatory Guide 1.27; Ultimate Heat Sink for Nuclear Power Plants, Revision 3; and preparation of ACRS reports.

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

We'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 and 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. I'll remind everyone in the room to please check and silence all of your little beepy devices.

A couple of other items of note for everyone sitting at the tables, we've made changes to our microphone system here. So if you look at the base of your little microphone there's a thing that says Push. You can now turn them off and turn them on. I'd request that everybody keep your mic off unless you're speaking because the rustling of the papers, these mics are so sensitive that they pick up and disrupt people on the bridge line that can't really hear us. So just touch the Push, the little light will come on, talk, turn it off when you're not talking.

We've got that. Remember, Dick Skillman is theoretically on a separate bridge line that should be open. Dick, are you out there?

MEMBER SKILLMAN: Good morning, John. I'm here. Yes, sir.

CHAIR STETKAR: Excellent. And I hope you're doing well. For those members who don't know, Dick was afflicted with shingles a couple of weeks ago and is hopefully on the mend. You doing okay?

MEMBER SKILLMAN: I am on the mend. Thank

you.

CHAIR STETKAR: Excellent.

MEMBER SKILLMAN: All who haven't had shingles shots I urge you to consider. This is something that none of us wishes to go through. And as Dennis Bley wrote, the pain is really formidable. So best to all. Thank you.

CHAIR STETKAR: Glad to hear you're on the mend and hope you get there.

MEMBER SKILLMAN: Thank you, John.

CHAIR STETKAR: With that unless any of the members have anything else, the first item on the agenda is the Grand Gulf MELLLA+, and Dr. Joy Rempe will lead us through that session. Joy?

MEMBER REMPE: Thank you, Mr. Chairman. On March 17th, our Power Uprates Subcommittee reviewed the Grand Gulf Nuclear Station Unit 1 operating license amendment request to allow operation in the expanded Maximum Extended Load Line Limit Analysis Plus, or MELLLA+ domain.

At the end of our meeting, our subcommittee recommended that this LAR be presented to the full committee. This LAR for operation in the MELLLA+ domain is the second to be reviewed by us. The first was the Monticello Nuclear Generating Plant.

And you shall hear today, several features of Grand Gulf which differ from Monticello are of particular importance with respect to MELLLA+ operation. Today we're going to hear presentations from the NRC staff and representatives from the licensee, Entergy Operations Incorporated, and part of the presentations will be closed in order to discuss information that's proprietary to the licensee and its contractors.

And I believe we're going to start today by hearing is it from George, or -- okay, yes, Wilson from the staff.

MR. WILSON: Good morning. I'm George Wilson, deputy director of the Division of Operating Reactor Licensing. I want to thank you for this opportunity to brief the committee on the MELLLA+ amendment for Grand Gulf.

The staff and the licensee last met with the ACRS subcommittee on this review on March 17th. The NRCS staff has determined that the operation in the MELLLA+ domain at the Grand Gulf Nuclear Station provides additional operational flexibility while not compromising the safety of the plant.

At this point I'd like to turn the meeting over to Meena Khanna, the branch chief for Plant

Licensing 4-2 which includes Grand Gulf. Meena?

MS. KHANNA: Thank you, George. Good morning. As George indicated, my name is Meena Khanna. I am a branch chief in the Division of Operating Reactor Licensing. Today we will be talking to you about the review of the Grand Gulf MELLLA+.

The Entergy license amendment request dated September 25th, 2013 proposes a revision to the Grand Gulf Nuclear Station technical specifications to allow plant operation from the currently licensed maximum extended load line limit analysis, MELLLA, domain to plant operation in the expanded MELLLA+ domain under the previously approved extended power uprate conditions of 4408 megawatts-rated core thermal power.

An EPU was approved by license amendment number 191 dated July 8, 2012 for Grand Gulf that increased the power level from 3898 megawatts-thermal to 4408 megawatts-thermal. When operating in the MELLLA+ domain, the operating power is maintained constant but the recirculation core flow is allowed to operate under a wider window than under the MELLLA conditions.

For Grand Gulf, the MELLLA+ flow window is between 80 percent and 105 percent flow. This

operating flexibility reduces the need for frequent control rod motion. I'd like to note that this is the NRC staff's second review of the request for implementation of the MELLLA+ domain, Monticello being the first. In both cases the licensees used the GEH approved MELLLA+ licensing topical report NEDC-33006, Revision 3, which is General Electric Boiling Water Reactor Maximum Extended Load Line Limit Analysis Plus for its submittal.

A portion of the NRC staff's presentation today will include a comparison of the significant differences between the Monticello and Grand Gulf MELLLA+ license amendment reviews. As first indicated previously, we did have an NRC subcommittee review meeting in March, and through that meeting there were several questions that were raised by the subcommittee. We have responded to all of these questions.

Again I will reiterate that the staff has determined the operation in the MELLLA+ domain at the Grand Gulf Nuclear Station does provide additional operational flexibility while not compromising plant safety. In addition, I would like to note that we currently have two additional MELLLA+ applications in-house for Nine Mile Point and Peachbottom. Both of

these applications are currently under staff review, and the ACRS meetings, subcommittee and full committee, will be scheduled in the near term. We thank you for your time.

At this point I would like to turn the meeting over to Bryan Ford of Entergy for their presentation of the MELLLA+ license amendment application for Grand Gulf. Thank you.

MEMBER REMPE: While we're switching speakers, Dick, is there a way to turn your phone on mute? Because we're getting a lot of background noise, I think, from your phone.

MEMBER SKILLMAN: I will go ahead and do it right now.

MEMBER REMPE: Thank you. Sorry to request it, but it'll help.

MR. FORD: Well, good morning everybody. My name is Bryan Ford. I'm the senior manager of Regulatory Assurance for Entergy. Thank you very much for taking the time to look at our MELLLA+ submittal today. It's going to provide some good flexibility for the plant going forward.

So today with me I have Greg Broadbent, the supervisor of Fleet Nuclear Safety Analysis; Jim Nadeau, the Grand Gulf Regulatory Assurance manager;

and Ricky Liddell, the supervisor at Grand Gulf Operations Training for Entergy.

Today what we're going to discuss is a brief overview of the plant and the benefits that we're getting out of the MELLLA+ analysis. We're going to talk a little bit about the safety analysis methods.

We're going to show a short video on the prime area operator action associated with the analysis. We're also going to discuss the ATWS-I analysis that was performed to support the amendment, and we're going to talk about the license condition associated with it. With that I want to turn it over to Jim Nadeau.

MR. NADEAU: Thanks, Bryan, and thank you to the committee for hearing us. Again I'm Jim Nadeau. I'm the Regulatory Assurance manager at Grand Gulf and I'm going to give a brief overview of Grand Gulf and MELLLA, why we want it.

Grand Gulf was initially licensed in 1984, became commercially operational in July 1st, 1985. We are a GE BWR 6 with a Mark III containment. We were originally licensed in 1984 to 3833 megawatts-thermal, and we're currently operating license limited at 4408 megawatts-thermal.

The MELLLA+ offers us improved operational flexibility in this extended region of 4408 megawatts-thermal. It gives us reduced reactivity manipulations, reduced operator challenges and reduced enrichments. Next slide.

The graph in front of you shows the current power-flow map. That's the white area inside the black line. The MELLLA+ region is the blue region that we're requesting and this gives us additional flexibility to operate reactor flows to change reactor reactivity.

As Meena was talking earlier, we've gone through the licensing. We've had 80 limitations and conditions that were in the licensing documents. We've met all 80. And we've had two audits by the NRC staff. One at GE Hitachi in April 2014, and also one at the Grand Gulf facility in the simulator to show that we could meet our operate time-critical operator actions. In both cases the audits were successful.

MEMBER BANERJEE: Ask you a question. I missed this in the subcommittee meeting, but --

CHAIR STETKAR: Sanjoy, it's one thing to turn the mic on, another thing to be sort of close to it.

MEMBER BANERJEE: All these things that I

have to learn towards the end of my career. But whatever. Your limiting transient for your ATWS, if I remember, was the turbine trip, right, without bypass?

MR. NADEAU: Without bypass.

MEMBER BANERJEE: Now if I should ask this in the closed session just say so, but that's fine. Whereas, the things that challenge the DSSCD mostly are the two RPT trip in terms of stability, and if I remember with Monticello that was the same thing. Why is that the case?

MR. NADEAU: Greg, is this a closed session?

MR. BROADBENT: Yes, that's something we can discuss in the closed session. We'll have a GE up here and we can talk the details.

MEMBER BANERJEE: Yes, I sort of missed that until I started to look at your things in more detail.

MR. BROADBENT: Yes, I'm not sure if we went into a whole lot of detail on that particular subject area, but --

MEMBER BANERJEE: Yes. Okay.

MR. NADEAU: Okay, now I'd like to turn it over to Greg Broadbent.

MEMBER SCHULTZ: One question. You mentioned you have 80 limitations. I thought there were also conditions associated with the application of MELLLA+. Are there no longer conditions associated with the application?

MR. NADEAU: There are license conditions associated with the application which we're incorporating through our license. We'll be talking about that later in the presentation --

MEMBER SCHULTZ: That's fine. Thank you.

MR. NADEAU: -- directly related to time-critical actions.

MEMBER SCHULTZ: Understood. Thank you.

MR. BROADBENT: And I'm Greg Broadbent, the Entergy Nuclear Analysis supervisor in corporate. With regard to the MELLLA+ analysis, we followed the guidelines and the standard GE MELLLA+ topical report, 33006.

The most challenging, the most different analysis associated with MELLLA+ is the ATWS analysis, and that's because in MELLLA+ you're operating a higher rod line. We presented this in some more detail for the subcommittee. But when the recirc pumps trip you end up at a higher ATWS post-trip power level and that causes things to happen faster. PCT

increases faster. The pool heats up faster and necessitates the need for quicker operator actions. And we have a 90-second operator action time to reduce reactor water level.

SLC is assumed in the analysis to happen at 300 seconds, and then to cool the suppression pool we put RHR and suppression pool cooling in 11 minutes. Now we recognize that the 90 seconds is a relatively fast operator action time, and I think we've got a video that Ricky will present that will go in a little bit more detail.

MR. LIDDELL: Good morning. I'm Ricky Liddell. I will be walking us through the video this morning, showing that we do in fact meet the 90-second time-critical action for determining feed flow to the vessel to reduce level. We did do a benchmark at the Monticello plant, and basically our operator response is similar to theirs. They were able to meet the 90-second time-critical action as were we. And so I'll cue up the video now.

MEMBER REMPE: Before you do that I have a question about the last bullet.

MR. LIDDELL: Sure.

MEMBER REMPE: The video, my understanding was the operators were given some training and they

knew that that transient was going to occur.

MR. LIDDELL: That's correct.

MEMBER REMPE: And will the training be the same way or are you going -- there's one thing to be told to do something and then you execute that action, and then there's another thing to be sitting in the control room and have an accident or a transient to occur. And how do you account for that in certain --

MR. LIDDELL: Our training in the staff, me and two of my instructors put that video together in a couple of hours. We looked at our EPs and how we would need to implement the actions to meet the 90 seconds. And essentially what we're doing is we're doing the same actions that we already do for an ATWS response. We're just eliminating the three-part communication between the CRS and the operators.

Now we were able to put that together pretty quickly with a minimum of training. We're going to give a minimum of two cycles of training to our operators, so they're going to have to cue off of an update from the at-the-controls operator that we're in a high power ATWS and they will know what actions to take based on that.

VICE CHAIR BLEY: Ricky, I don't remember

from the subcommittee meeting, I don't recall anyone talk about that for this activity you suspended the three-way communication that you just said.

MR. LIDDELL: What we're doing is --

VICE CHAIR BLEY: I mean that gets you done faster but it might get something else done.

MR. LIDDELL: Yes, we have several actions, time-critical actions that we do already in response to a reactor scram or a turbine trip. So immediate operator actions have to be performed by memory. They're not required to have a supervisor direct and the operator is expected to recognize the three conditions for those --

VICE CHAIR BLEY: Do they have a post-activity communication requirement?

MR. LIDDELL: Yes. Since the standard heat reports that I did immediate actions one, two and three, that's correct.

MEMBER BROWN: Does the simulation actually show the trigger or what alerts the operator?

(Simultaneous speaking.)

MR. LIDDELL: And I'll explain what the cues are.

MEMBER SKILLMAN: Ricky, this is Dick Skillman. Can you hear me, please?

MR. LIDDELL: Yes.

MEMBER SKILLMAN: Sir, what I want to ask you is a reinforcement of Dr. Rempe's question. What I heard you just say is that there are other events for which you have immediate operator actions, your TCOAs, time-critical operator actions, and that your operator's performance for those events coupled with what you witnessed in the ATWS give you confidence that the TCOAs will be accomplished in the required time period. In other words, you're building not only on the ATWS event but on other similar events that cause the operators to take immediate manual actions. Is that what you intend to communicate?

MR. LIDDELL: Yes, sir. If we're in an ATWS and let's say we had other off-normal events that had immediate actions, the ATWS and entry into our EP2A would be the overriding priority, and it already is. We respond to other immediate actions already as secondary to our ATWS EP directions.

MR. FORD: And this is Bryan Ford. A little bit more clarification. During our training, one of our license conditions is to document the amount of time it takes for our different shifts to perform this action and to provide a report to the staff that shows that we were able to meet it for the

applicable shifts.

MEMBER SKILLMAN: Thank you. Are there other immediate time-critical actions for other transients or events that are just as stringent required compliance as ATWS?

MR. LIDDELL: No. But we do have other immediate actions that we take for such as a jerking control rod, the operator's supposed to immediately drive that control rod fully in. So the trip of a control rod drive pump, the operator immediately recognizes that and starts the second, the standby pump.

So those are the kind of critical, not time-critical but I would say time-sensitive actions that we do have in place.

MEMBER SKILLMAN: And what is the track record for operator response? Spontaneous operator response not rehearsed to those types of events?

MR. LIDDELL: I can give you an example. Recognition of THI, thermal hydraulic instability, we have some scenarios last cycle with that. And I think the longest for an operator to recognize that and take an action was about ten seconds based on the availability of the indications. So for the ones that we train on as immediate operator actions we have not

seen any specific weaknesses in the operator response.

VICE CHAIR BLEY: Ricky, that was a real isolated event, right, or was it a simulator?

MR. LIDDELL: No, ours was in the simulator. There was --

(Simultaneous speaking.)

MR. LIDDELL: But it was not ours.

VICE CHAIR BLEY: Okay.

MEMBER SKILLMAN: Ricky, thank you.

MR. LIDDELL: Sure. I'm going to go ahead and expand this. What I'll do first is just discuss the locations on the panels where there will be actions that'll be taken initially. This is the -- and I apologize for the ones that are on conference call, but I'm looking at the full core display.

We have our at-the-controls operator seated in the controls area, and he will receive a couple of alarms indicating a scram and we'll respond to those with the immediate operator actions for a scram. Once he recognizes that we have a ATWS condition then he will provide an additional update for that which will be the cue for he and the second operator and also the CRS to enter the EP2A which is our ATWS emergency procedure. So we have --

VICE CHAIR BLEY: Just for everybody here,

for you guys, the CRS is the SRO.

MR. LIDDELL: That is correct. Control room supervisor. And what, his desk is off-camera but for EPs and off-normal events he would move down to the control room operator's desk and so he'll come into view which will be me. All right.

MEMBER BROWN: Before you -- where are the alarms indicated where this operator is going to respond to?

MR. LIDDELL: Okay. What we're going to get is I've got to get reactor scram alarms right here on the indicators next to the full core display. And what he has to do is to test, verify that all rods are in. In this case there will be no rods inserted as a result of the scram signal.

So we'll remain in 100 percent ATWS condition until we will get a recirc pump trip that will occur on pressure because of the turbine trip. Even though we have bypass we'll still have high reactor pressure, enough that we will get an automatic actuation of the recirc pump trip and alternate rod insertion.

Now there will be some additional alarms that you can see over here on this left side of the 680 panel. So those will be an indication that ARI-

RPT, alternate rod insertion-recirc pump trip has actuated. Now what that means for us is the operator action to downshift the recirc pumps and to initiate ARI-RPT will not be required. We do expect the operator to go ahead and go through those just to verify that all those signals are received. So you will see him initiate those actions, but we can tell by the alarms that they've actually already occurred.

MEMBER BROWN: So it's the absence of the rods, you've got a scram but no rods go to the bottom.

MR. LIDDELL: That's right.

(Simultaneous speaking.)

MEMBER BROWN: There's some other, it's the turbine trip that comes along with it?

MR. LIDDELL: If I get indications of a turbine trip, you know, have indications of a scram --

MEMBER BROWN: I'm just trying to --

(Simultaneous speaking.)

MEMBER BROWN: -- the two or three things he's going to cue on that he has to see to say okay.

MR. LIDDELL: The APRM that you've got four channels of average power range monitors on that section of the panel and they will, even after the recirc pump trip they will still be indicating about 40 percent.

MEMBER BROWN: Okay.

MR. LIDDELL: So you'll hear him give an update, 40 percent ATWS. That 40 percent is the 40 percent for thermal power that we still have after the recirc pump trips. Because that's the initial plant response that's going to drive power down otherwise we would still have 100 percent. But that pressure spike is going to initiate automatic response.

MEMBER BROWN: Okay, thank you.

MR. LIDDELL: Now also on this section of the panel to the left of the at-the-controls operator are the feedwater controls. This control room operator will actually respond to control feedwater. The at-the-controls operator after verifying that we are in an ATWS and taking initial actions to verify that the recirc pumps are downshifted and tripping one feed pump, now we trip one feed pump because the feedwater control system is going to ramp injection back as far as it can.

But the feed pump speed with both feed pumps still in service are really going to feed more than we need in this situation, so tripping one feedwater pump will reduce feedwater injection and allow us to maintain the level.

Now our initial actions are really just to

stabilize level. I will give, or the CRS will give an order to terminate and prevent feedwater injection, and that includes not only just reducing the injection to zero but isolating the flow paths so that if reactor pressure were to drop we wouldn't get an inadvertent feedwater injection. So that order of terminate and prevent encompasses all actions to terminate feed flow and also isolate the flow paths to prevent the injection.

CHAIR STETKAR: Ricky, just education because I come out of the PWR world and I sort of know how boilers work, but as you get out of the initial transient how are they instructed to control level after that? What do they do?

MR. LIDDELL: The EPs, EP2A will drive that. What they'll do is CRS will give out a lowered level band. In this case the initial level band is going to be minus 70 inches wide range to minus 130 inches wide range. We'll line up the feedwater in a, we'll call a start-up lineup.

CHAIR STETKAR: Okay, but they do restore feedwater flow?

MR. LIDDELL: Correct.

CHAIR STETKAR: Okay.

MR. LIDDELL: And you'll see that action.

That'll be one of the first things that he does is to terminate feedwater and then line up in the start-up level lineup.

A few other actions that are going to occur, if you look over to the right side this is our 601 panel which has our SRVs, standby liquid control. The SRVs, we want to make sure that they don't inadvertently initiate on a low level.

So one of the first actions in our ATWS response is to inhibit ADS, so you'll hear that order given. Inhibit alternate depressurization system. And that's done with just two switches, keylock switches, so that's one of the first actions that'll be taken.

Also high pressure core spray, since it will initiate on a level 2 which we will receive a level 2 when we start lowering, we want to override high pressure core spray before we start lowering level to the point of initiating high pressure core spray.

So the initial actions that you'll see will be the at-the-controls operator will respond to the scram, take the mode switch to shutdown, recognize that the rods are still out and we're at approximately 40 percent based on APRM indications. He'll give an

update and then once he gets the update the other operator then knows that he needs to go inhibit ADS and override high pressure core spray.

The at-the-controls operator will also trip a feed pump, and at that point the control room operator will come back over and take over feedwater and then he will maintain feedwater through the rest of the event.

MEMBER SCHULTZ: Inhibiting the ADS is time-critical?

MR. LIDDELL: It is not. It's not a time-critical action specifically, but it's one that we do in parallel with the others. Our EP initial actions are ordered such that before you terminate and prevent feedwater injection you take those other actions, so they'll be doing those first.

And those are some of the actions that if we don't get those done immediately we can't get to the step to terminate and prevent feedwater. So it is important that they do those as immediate actions without having to wait for the CRS to give that command.

MEMBER SCHULTZ: Thank you.

MR. LIDDELL: All right, so I'm going to start the video. And I'm not getting, I don't see a

timeline.

MR. FORD: You'll have to make it a little smaller.

MR. LIDDELL: All right, yes, this will work. So what I'm going to do is I'm going to go ahead and run the video one time through and it'll take just a couple of minutes. And then I'll go back and I'll freeze it at certain points, anybody wants me to stop at a certain point. But I think it would be good to run through it one time without stopping just to give you an idea of the actions and the time frame that they tell you.

(Video played.)

MR. LIDDELL: (Narrating) The reactor scram alarms are coming in, and also -- now the at-the-controls operator, he's verifying that the recirc pumps have tripped. The other operator has overridden high pressure core spray and inhibited ADS. He's coming around to take over feedwater now.

He's now reducing injection. That's where we'd get our high pressure core spray initiation if it hadn't already been overridden. Okay, I'll stop it there.

(Video stopped.)

VICE CHAIR BLEY: When you run it again

would you stop at the point they do the things they need to do in 90 seconds?

MR. LIDDELL: Absolutely.

VICE CHAIR BLEY: Yes, thanks.

MR. LIDDELL: So on our timeline right now we're two minutes and 55 seconds from the start of the video. The scram came in at about ten seconds, so we're about two minutes and 45 seconds in. Our standby liquid control which that's a 300-second activity so that has been completed. And the 90-second for the terminate and prevent. So this time I will freeze it.

(Video played)

MR. LIDDELL: (Narrating) Now he just tripped a feed pump which is going to help with our level.

MR. MARCH-LEUBA: Can you freeze it there? Can you freeze it?

(Video stopped.)

MR. LIDDELL: Sure.

MR. MARCH-LEUBA: Yes, this is Jose March-Leuba. Can you point out the line, the alarms where they identify the scram happen?

MR. LIDDELL: Yes. All right, let me back up. Okay, so at this point we've got a couple of red

alarms here. There's also going to be one that comes in here. What's happening is we're going to get some multiple scram signals. We're going to get, initially you just get the reactor scram and based on that alone his immediate action is to verify that the rods are inserted, which they're not, take the mode switch to shutdown which actually gives two additional signals for shutdown and they don't cause the rods to insert either.

So at that point the recirc pumps have tripped on high pressure and he's going to look and recognize that we're at a 40 percent power.

MR. MARCH-LEUBA: So this is Jose again. Before operator got off the chair he already knew the scram was supposed to happen because he saw those red lights, correct?

MR. LIDDELL: That's correct.

MR. MARCH-LEUBA: And now he's looking probably at the APRM display to see where the power is?

MR. LIDDELL: That's correct.

MR. MARCH-LEUBA: Can you point where the control rod insertion will show up?

MR. LIDDELL: Yes. This section here is just a graphical display of the core. All this red

should be all green. You should have full-in indication green lights on all of these rods. So just based on a glance, you know, we all can see that this is red and not green. So that's your first.

MR. MARCH-LEUBA: What initiated the scram in this case?

MR. LIDDELL: The turbine trip initiated the scram on high pressure. That's going to be the first one you're going to get. You're also going to get an APRM flux scram, then he's going to get, due to the level at, pretty soon you'll get a level scram signal.

So there's multiple scram signals that are coming in, but initially the pressure because you've basically got 100 percent power you've only got 30 percent capacity on your bypass valves, so you're going to be lifting SRVs over here but that happens after your scram signal.

CHAIR STETKAR: This is the turbine trip with bypass as opposed --

MR. LIDDELL: Turbine trip with bypass.

MR. LIDDELL: We ran them both. The response of the crews is the same but --

CHAIR STETKAR: The timing, you know, the level response will be a little different.

MEMBER BANERJEE: This is 100 percent power, is it?

MR. LIDDELL: Initially we're at 100 percent power. With the scram signal until the recirc pumps trip on high pressure we're still at 100 percent. But as soon as the recirc pumps trip then you're going to have boiling in the core and --

MEMBER BANERJEE: Does it make any difference if you're at 80 percent flow or something or what's the flow again? Full flow, full power.

MR. LIDDELL: I think that this one over --

MR. BROADBENT: Yes, this was from the MELLLA+ region so this is the highest rod line that we can get to.

MR. MARCH-LEUBA: This is Jose again. You guys know too much and are making it a little complicated. Ultimately the point from the human factor point of view, which is the one we're really more concerned about, before operator got off the chair he'd already seen that the scram signal had happened and the rods had not gone in. So even before he got off the chair, two or three seconds, he knew that he was in an ATWS.

MEMBER BANERJEE: Yes.

MR. MARCH-LEUBA: It was going through his mind what do I have to do next.

MEMBER BANERJEE: Yes, I'm just trying to establish the initiating conditions.

MR. MARCH-LEUBA: Yes, that's important. But from the human factor point of view it's not that complicated.

(Simultaneous speaking.)

MEMBER BANERJEE: Eighty percent flow?

MR. BROADBENT: Eighty percent.

MEMBER BANERJEE: Eighty percent flow, that's been established and it's a turbine trip.

VICE CHAIR BLEY: I'm sorry. Jose, from a thermal hydraulics point of view you're right. The guy in the control room, the complication is what makes his job.

MR. MARCH-LEUBA: Correct. He's to oversee --

VICE CHAIR BLEY: This all matters.

MR. MARCH-LEUBA: He needs to go through everything.

VICE CHAIR BLEY: I have just a quick question, Ricky, on what you guys do. I noticed this and I noticed nobody looking at it, or maybe you were looking at it. The guy said, I'm going to do an

update, and the other two guys hold their hands up. So at the CRS if he didn't see the other hand go up would say, wait a minute.

MR. LIDDELL: Yes. You're fixing to get some information -- that's right.

VICE CHAIR BLEY: I saw two hands going up. I was, oh that's weird.

MR. LIDDELL: Okay. No, the hands going up is something that we've adopted just to make sure that whoever's giving the update knows that everybody's listening.

VICE CHAIR BLEY: But his back's turned. But go ahead. Every time.

(Video played.)

MR. LIDDELL: (Narrating) All right, so just a couple of seconds. The mode switch is in shutdown. We're just going to give you a redundant scram signal but it's not going to make a difference.

(Video stopped.)

MEMBER BANERJEE: Okay, so at this point, 31 seconds, we've taken the two actions to inhibit ADS, override high pressure core spray. He has gone through the actions to ensure that ARI-RPT has been initiated. It did auto-initiate based on this red alarm and tripped one feed pump.

MEMBER BALLINGER: The board is still red though, right?

MR. LIDDELL: That's correct.

(Video played.)

(Video stopped.)

MR. LIDDELL: Now what this operator's doing right now, he hasn't been given an order to terminate and prevent feedwater, so but what he is doing is lining up the feedwater system so that he can maintain in a band. And what he's going to have to do is he's going to reduce the pump speed so that he stops injection and he's going to isolate that flow path.

And he's going to have to walk around to this other panel and line up the start-up level control flow path, so you'll see at one point he's walking away from the panel. That's part of his action that he has to do to complete the terminate and prevent process. So don't think -- you know, he's going to where he needs to be to complete that action.

But the key point here is once he has terminated injection that action is complete. To be able to prevent a subsequent injection he has some other actions, but as far as the initial action to terminate feed flow that will be complete, and I'll

show you when that happens.

VICE CHAIR BLEY: What's he carrying around? Is that a little check sheet for immediate actions or something?

MR. LIDDELL: That's correct.

MR. FORD: So he's just about to take the action, is the 90-second action.

MR. LIDDELL: That's correct.

(Video played.)

(Video stopped.)

MR. LIDDELL: Okay, now he was already reducing feed flow, and I'll show at what point.

(Video played.)

MR. LIDDELL: (Narrating) All right, so he's reducing injection right there.

(Video stopped.)

MR. LIDDELL: He's done at that point, okay. He initiated the action. It took about, you know, five or so seconds. So right now we're at, we had seven seconds, so nine and three, you know, we're at about 85 seconds for him to complete the action, but he had already reduced the injection flow several seconds before that.

VICE CHAIR BLEY: And that's the 90-second action.

MR. NADEAU: The 90-second action is to initiate.

MR. LIDDELL: That's right.

MALE PARTICIPANT: Initiate what?

CHAIR STETKAR: Initiate, well, I mean, you know, you can call initiate tripping the first feed pump. But is it --

MR. LIDDELL: That's true, but there's several things that are happening to reduce injection rate. But when he finally has all injection terminated, which he has right here, it's about 85 seconds.

CHAIR STETKAR: So is the time window to get injection flow to, I'll use the term "zero," or is it the time to get injection flow less than normal injection, to start getting injection flow less than normal?

MR. LIDDELL: It is to reduce, we're --

CHAIR STETKAR: What I'm trying to understand is he very quickly trips the first feed pump. That drops it probably to 70 percent, roughly.

VICE CHAIR BLEY: And is that the 90-second time window or is it to get it to zero?

MR. LIDDELL: No.

CHAIR STETKAR: Or actually to get level

down to --

MR. NADEAU: Is not to get it zero. Very quickly at about 20 seconds when he trips the first feed pump that is not, we have not completed initiation of reducing flow.

(Simultaneous speaking.)

MR. NADEAU: About 60 seconds.

MEMBER REMPE: So this is the time you report to the NRC for your condition.

(Video played.)

(Video stopped.)

MR. LIDDELL: So he is reducing feed flow at this point and this is, you know, 78 seconds. So approximately at 71 seconds he's taken the action that --

VICE CHAIR BLEY: So that's the 90 seconds then is when you actually start running it back.

MR. NADEAU: That's right.

VICE CHAIR BLEY: Okay. That's what we didn't quite understand. And for this case that's 70 seconds.

(Video played.)

VICE CHAIR BLEY: This case is pretty clean.

(Video stopped.)

MR. NADEAU: Are there any more questions on the video?

CHAIR STETKAR: Charlie. Push the button, Charlie, when you're going to talk.

MEMBER BROWN: Oh that's right. Can I ask the question again since he didn't hear me? I don't think I needed that but --

CHAIR STETKAR: Well, it's the recorder because the mics only go to the recorder.

MR. LIDDELL: So to answer your question, one of the things that we do early on is we'll call for three attachments to be installed which will bypass the interlocks that prevent us from inserting control rods. They'll bypass interlocks that prevent us from resetting the scram and allow us to take actions to start inserting rods.

But at this point there's really nothing we can do to insert rods until those attachments are in. The scram signal's already there. We can't manually drive rods because, you know.

MR. BROADBENT: Right. The analysis assumption is that you never get rods in. It gets shut down with the SLC.

MEMBER BROWN: Okay.

MR. BROADBENT: And you saw when he

initiated SLCs.

MEMBER BROWN: That was my question. It's a later action manually taken to finally insert, pull up, whatever the term is. I'm a PWR guy --

(Simultaneous speaking.)

CHAIR STETKAR: Before -- I don't have any questions on the simulation, but, you know, reducing feedwater flows is a pretty standard ATWS response on all boilers. What, now there's a magic 90-second time window, and I wasn't here in the subcommittee meeting. I'm not a boiler, thermal hydraulics, core neutronics, anything guy. What was, did you have a nominal time window in the past to reduce feedwater flow?

MR. LIDDELL: Typically two to three minutes.

CHAIR STETKAR: Two to three minutes, okay.

MR. LIDDELL: And the reason it took longer, you're doing all the same actions but you're three-parting just about every action and they're all being done in sequence versus parallel.

VICE CHAIR BLEY: So that's the main difference is getting rid of the three-way communication.

MR. LIDDELL: That's right. And allowing

a couple of actions to be done in parallel versus sequentially.

CHAIR STETKAR: Okay, thank you.

MR. BROADBENT: Okay. And continuing on with the presentation, there were a few requests from the subcommittee. One on operator action times, one associated with the TRACG Tmin and the underlying bases and references and all, and another one associated with PCT margin.

The staff, the NRC staff answered the first one. We'll let them discuss that in their presentation. The second one, we did provide a response. We listened to references, and if you want to get into the details with that we can do it in the closed session.

And then the third one was with regard to PCT margin. And talking about PCT margin, we, you know, the ATWS-I and the ATWS analysis, their best estimate analyses, we do apply some conservative values in some of these sensitive inputs in the analysis. In three cases, in three areas, for example, we assume a minimum core flow of 80 percent which is the lower band of our window. We don't actually design the core all the way down that far, we actually only design the core to 85 percent.

So we used a nominal value and some of the sensitivity evaluations of 85 percent. Same thing with rod peaking. The license basis analysis assumed that we're at 95 percent of the LHGR limit. We design with ten percent margins, so we use the actual margins for LHGR. Also there's a feedwater temperature transient that occurs in an ATWS, and we assumed a bounding or a faster drop than expected. So we, in our sensitivity evaluations we used a more realistic value for that.

MEMBER BANERJEE: So just before we go on because this is interesting. Clearly when you look at this you have to get some uncertainties because this is a best estimate calculation.

MR. BROADBENT: That's right.

MEMBER BANERJEE: And so you have to put some distributions and bounds on these parameters which because you're sampling. So do you do the sampling of this to look at your uncertainties?

MR. BROADBENT: I think that was part of the RAI response where we described an evaluation that had been performed. For the actual analysis we give GE numbers and then they generate a PCT trend.

MEMBER BANERJEE: Well, they do a single calculation.

MR. BROADBENT: Right, right.

MEMBER BANERJEE: And you were appealing to another calculation done for a different situation, right?

MR. BROADBENT: That's right. We could talk about that in the closed session.

MEMBER BANERJEE: So we need to go into that in some detail which you did.

MR. BROADBENT: Okay. Just some results associated with this. We have a graph in the closed session with actual numbers on the y-axis, but this is still a good comparison, where the red line is the license analysis and you could see we have oscillations early due to the conservative assumptions that we applied.

The green and the blue is where we use the nominal assumptions, and with the blue we still assume the 90-second operator response time, and you can see that we barely saw any oscillations. And with the green we assumed 120-second operator response time, and there were some oscillations but it was bounded by the license basis case.

MEMBER BANERJEE: So what's the difference between the red and the green and the blue?

MR. BROADBENT: The red is the base case.

That's our license basis analysis. That's the case GE ran and the PCT trend that we saw. That's the case that's in our MELLLA+ safety analysis report.

MEMBER BANERJEE: Right. So what is the difference? What changed between these?

MR. BROADBENT: Well, it was these three things. We assumed, instead of 80 percent we assumed 85 percent core flow.

MEMBER BANERJEE: Oh, okay. But what are you going to be allowed to operate in?

MR. BROADBENT: We're allowed to operate at 80 percent. We can --

MEMBER BANERJEE: That's the case that's important, right?

MR. BROADBENT: Right.

MEMBER BANERJEE: You may want to do something else, but yes.

MR. BROADBENT: And we're just trying to show the sensitivity of that.

MEMBER BANERJEE: Can you go back to that slide please? The previous one. So if you ran the base case you're well into oscillations at 90 seconds.

MR. BROADBENT: Yes.

MEMBER BANERJEE: Okay.

MR. BROADBENT: And that's when we start

to level everything.

MEMBER BANERJEE: But you stop the actions no matter whether you're in oscillations or not.

MR. BROADBENT: That's right.

MEMBER BANERJEE: Right.

MR. BROADBENT: Right, they're procedurally driven.

MEMBER BANERJEE: Yes, they're procedurally driven.

MEMBER BALLINGER: Now we can go into this, I'm sure, in the closed session, but I'm looking at the time scale. Is it physically possible for fuel temperature, and I don't know what the left hand scale is so --

MR. BROADBENT: We've got it in the closed session.

MEMBER BALLINGER: Okay. This is a calculation so --

MR. BROADBENT: That's right.

MEMBER REMPE: So on the prior side you said you removed some of these conservatisms.

MR. BROADBENT: Right.

MEMBER REMPE: Can you give us a feel in the open session which of the conservatisms you removed had a larger impact? Because as Sanjoy said

you're allowed to operate in 80 percent. Is that the one that really made the difference?

MR. BROADBENT: I'm not sure I know the answer to that, which ones were the most important. We can answer that. And Mike, do you have a --

MR. COOK: This is Mike Cook from GE Hitachi. Is this mic on?

MR. BROADBENT: Yes.

MR. COOK: The feedwater temperature response is probably the most important here.

MEMBER REMPE: Thank you.

MEMBER BANERJEE: And when you mean the bounding faster drop, how much faster, or can you tell us that here?

MR. BROADBENT: So maybe we should --

MEMBER BANERJEE: Yes, okay. If you can't answer these questions here.

MR. BROADBENT: We can discuss them in closed session.

MEMBER BANERJEE: We need some numbers.

MR. BROADBENT: Significantly faster than what we would expect. And Jim, do you want to talk about license conditions?

MR. NADEAU: Thank you. Time-critical operator actions will be incorporated into our license

conditions. It will include the training of the operators, the validation that they can all meet the time-critical actions that we specified earlier, and we will report the results to the NRC prior to operating in the MELLLA region. Next slide.

So overall conclusion is Grand Gulf can operate safely in the MELLLA+ region. We're confident of that because we've got a good quality analysis, we've got a good quality training program, and time-critical operator actions will be met.

MEMBER SCHULTZ: I thought there was a condition related to single-loop operation. Is that no longer applied in the MELLLA+?

MR. NADEAU: No, it's there.

MR. FORD: We have a license condition that says we can't operate in single-loop or loss of feedwater or you're removed from service.

MEMBER SCHULTZ: Thank you.

MEMBER BANERJEE: Is that because, is single-loop, generally single-loop operation is not limiting with regard to stability, if I understand the situations. So maybe I should ask the staff. Why is, I mean generally it's the two RPT pump trip that gives you the limiting conditions for stability.

MR. MARCH-LEUBA: That is correct. That

will give you the worst transient. However, in the MELLLA+ domain one unit's in a such high home (phonetic) line, going into single-loop gets you in the bottom of that MELLLA+ and we don't really want to them to operate there. So it would be very difficult for them to operate in MELLLA+ and single-loop.

MEMBER BANERJEE: Agreed, agreed. Yes, sure.

MR. MARCH-LEUBA: So indeed it becomes pretty handy, because the last incident that happened last month was because single-loop operation. So it was good foresight. And they don't need it and I don't think the staff would ever release that requirement for it.

MEMBER BANERJEE: And I guess they run both transients and see, but usually it's the two RPT which is limited --

MR. MARCH-LEUBA: Well, the RPT uses half the flow. So yes, absolutely.

MEMBER BANERJEE: Right.

MEMBER REMPE: We're running a little bit behind so I think we need to switch to the staff's open presentation.

CHAIR STETKAR: I just wanted to ask one more question. Ricky, do you have a rough estimate of

how many unplanned scrams you've had at Grand Gulf in the last five years?

MR. LIDDELL: We've had two this cycle. We had five, I believe, the previous cycle.

CHAIR STETKAR: So you get a couple issues though per cycle?

MR. LIDDELL: Yes.

CHAIR STETKAR: Thanks. That helps.

MEMBER REMPE: Can we move to the staff? And thank you.

MR. A. WANG: Good morning. My name is Alan Wang. I'm the project manager for Grand Gulf Nuclear Station. I had two slides most of which has already been gone over, so I'll just go to the second slide.

So basically as discussed we do have two license conditions as part of the approval for the amendment. One is on the single-loop operation and the other one is on the operator training requirements.

There are three amendments tied to this submittal. Of the three, the most important is the effective fluence in the MELLLA+ operation. That is still staff review. We expect to finish that in June and we expect to finish the MELLLA+ amendment in June

also, by the end of June. The other two are the Safety Limit MCPR which had been increased for a MELLLA+ operation. That safety evaluation is completed.

MEMBER BANERJEE: Is that because there was some uncertainty in the power distribution, or what was that increase?

MR. JACKSON: Well, I think that the applicant would be better off answering that. But the Safety Limit MCPR is sort of cycle dependent, depending on how you load the core or how you design the cycle. So that MELLLA+ needs to come in 18 months in advance, so it's not unexpected that we'd get the Safety Limit MCPR. That amendment's been approved. It's finished. We're just making sure the SER is in line exactly with this one so that there's no --

MEMBER BANERJEE: So it's just a penalty of some sort.

MR. JACKSON: Yes.

MEMBER BANERJEE: It's 0.02 or something, what is it?

MR. JACKSON: We were fined the penalty. I have it on my desk, 0.02, because their power density is greater than 42. So I have that. But that wasn't unexpected given that we get those six months

before the end of the cycle relatively routinely, so.

MR. A. WANG: And then the last amendment is they will be adding the DSSCD to their COLA as one of the references that allow them to use DSSCD in future refueling outages and won't require staff review for approval.

MEMBER BANERJEE: They're not already using DSSCD?

MR. A. WANG: No, the MELLLA+ will approve the use of DSSCD for the Grand Gulf Station, but the amendment will add it to the COLA so for future outages they can use the methodology without coming back in for staff --

MR. JACKSON: DSSCD was updated to use TRACG-04, so they have that in GSTAR and it's available to them if they want to use the more recent approved version. And that's what they're looking for --

MEMBER BANERJEE: They will want E1a, or what do they, how were they operating the thing before? Were they in option 3 or --

MR. JACKSON: Yes.

MEMBER BANERJEE: They were in option 3.

MR. JACKSON: They were using DSSCD before. They can use that with their current tech

specs or with their currently approved because the prior version of DSSCD is a GSTAR which is in their tech specs. But the later version that incorporates TRACG-04 is not, so they want to incorporate that. That review's been done. That of course applies. There's no technical review associated with that. But the technical review has been done and associated with this MELLLA+ application. So DSSCD is a good thing for TRACG-04, the latest version's a good thing.

MEMBER BANERJEE: I'm just trying to understand, when they went up to EPU level didn't they start DSSCD at that point?

MR. JACKSON: I don't think so. I think they --

MEMBER BANERJEE: They stayed in option 3?

MR. JACKSON: Yes. Can you confirm that though?

MR. BROADBENT: Yes, this is Greg Broadbent with Entergy. We were E1a until EPU, and then for EPU we went to option 3. And then for this, for MELLLA+ we're going to DSSCD.

MEMBER BANERJEE: Okay, but you haven't actually put the plant under DSSCD yet. Once this is approved you will.

MR. JACKSON: Once this is on it's

required.

MEMBER BANERJEE: It's not on. Everything is there.

MR. A. WANG: The hardware is there, it's just not on.

MEMBER REMPE: On the first one about the fluence, during our subcommittee meeting I was left with the impression that it was a sure bet that you would have the amendment approved and that doesn't sound so sure now. What would be the ramification? Will you hold off on approving the MELLLA+ until it is -- so could I rephrase what you're saying. We will not if, it'll be both will be approved in June or both will be approved whenever they both can be approved?

MR. A. WANG: You're right. The fluence has to be approved first and then MELLLA+. But we're expecting to approve the fluence in June and then the MELLLA+ will follow.

MEMBER REMPE: Thank you for clarifying.

MR. A. WANG: And actually that's all we had for the open for the staff.

MEMBER REMPE: So at this point we need to stop and open the mics if there's anyone that has a question from the public and allow anyone in the room to come up with comments. And comments from the

public, not questions. I should be more careful how I word that. I assume since nobody's going to the mic there's no one in the room that has any comments?

MR. W. WANG: The public line is open now.

MEMBER REMPE: Okay. Is there anyone out on the line from the public that would just speak so we know you're there?

MR. LEWIS: My name is Marvin Lewis.

MEMBER REMPE: Okay, thank you. Are there any comments from the public at this time?

(No response.)

MEMBER REMPE: And with that I think we'll close the public lines and we'll go into closed session. And I'd like for the staff or the licensee to confirm that only those who are supposed to be here are here.

(Whereupon, the above-entitled matter went off the record at 9:44 a.m. and resumed at 11:00 a.m.)

CHAIR STETKAR: We are back in session, and this is an open session so we have the bridge line. I'm assured that we have a bridge line open to the public. And the topic of this session is Reg Guide 1.27, and Harold Ray will lead us through this session. So Harold, it's yours.

MEMBER RAY: I had it right here in front

of me ready to do that and failed.

CHAIR STETKAR: Operator training.

MEMBER RAY: Training again, yes. I'm glad that we have coaching when we need it. Anyway, Regulatory Guide 1.27, Ultimate Heat Sink for Nuclear Power Plants, is being revised for reasons which will be described by the staff during our presentation.

The pending revision, Revision 3, was reviewed by the Regulatory Policy and Practices Subcommittee on March 4th. At that time the staff had resolved public comments and these were summarized as part of the staff presentation.

Today the staff will also summarize their resolution of comments and questions from members received during the subcommittee meeting. Because we've spent a good deal of time these days on a couple of items that are not included in the Reg Guide revision, I would like to mention these before the staff begins.

The first item not included is guidance which would apply to review of passive reactor designs. Because passive designs have unique attributes which have thus far been reviewed on a case by case basis, to maintain clarity of the detail in the Reg Guide it continues to be limited to active

plants use water as an ultimate heat sink.

The second item not included is accidents resulting from beyond design basis events. Currently at a multi-unit site only one unit is assumed to be in an accident condition. Other units can be assumed to have tripped. At the subcommittee meeting the staff indicated that guidance is being developed separately by JLD staff to address simultaneous, multi-unit action conditions due to a beyond design basis external events.

That concludes my initial remarks, and I understand that Brian Thomas will start us with some remarks.

MR. THOMAS: Yes, good morning. Brian Thomas from the Division of Engineering in the Office of Research. I'll just very briefly before the staff gets going let me just say that indeed we're at the Revision 3 version of the Reg Guide.

This is a very old Reg Guide. It was last revised back in 1976. So basically the approach with the update to this Reg Guide has to do with incorporating, you know, the last 40 years of operating experience. The staff is committed to update Reg Guides on a regular basis. Of course the, you know, the Reg Guide update program was embarked

upon in a more focused manner back in 2006, of course when the Commission directed the staff to do so. Of course that was with the expectation of a renaissance.

So the Reg Guide update program, I would say it's in full stride now in terms of regular updates and periodic reviews of the Reg Guides. The staff has briefed the ACRS. It's the Regulatory Policy and Practices Subcommittee as Harold said back on March 4th.

The comments and the suggestions of the ACRS members are incorporated into the Reg Guide specifically with regard to some of the items such as like to how to address this passive plant, so not addressed in the Reg Guide but we have the appropriate staff here to respond to some of those questions if the committee has further questions.

So with that I'll turn it over to the staff to make their presentation. Thank you.

MR. LIN: Okay, thank you, Brian, for the introduction. I'm Bruce Lin. I work at Office of Research Division of Engineering. With me up here is Jerry Purciarello with NRR Division of Safety Systems. We appreciate the opportunity to brief the committee on the proposed Revision 3 to Regulatory Guide 1.27.

This is an outline of what we plan to

cover today. I'll briefly provide you with an overview of Reg Guide 1.27 and what's covered in the Reg Guide and the purpose of the Reg Guide and the reason for the revision, and also give you a high level summary of the changes that were made in the Revision 3. And then I'll turn it over to Jerry. He's going to talk about more details on the technical changes that were made.

And also we're going to briefly touch on the public comments. We don't plan to go into details on the public comments since those were discussed in length at the subcommittee meeting, but we did include some of the significant comments and the staff responds as the backup slides. And then we're going to address like Brian said and Jim and Ray said, we're going to address some of the subcommittee comments in this presentation.

Just a little bit of background on what is ultimate heat sink. The ultimate heat sink is the system of structures and components and associated water supply that's credited for functioning as a heat sink to remove reactor decay heats and essential station heat loads after a normal reactor shutdown or a shutdown after an incident. This will include the necessary water retaining structures and the piping

systems that connect the water supply to the essential cooling water intakes.

So essentially the UHS performs three principal safety functions. Removal of the residual heat after reactor shutdown, dissipation of the residual heat after an incident such as a loss of coolant incident, and also removal of the maximum expected decay heat from the spent fuel pool.

So this slide is just to provide a high level overview of what's in Reg Guide 1.27. Basically Reg Guide 1.27 provides methods and procedures that licensees and applicants can use to establish the ultimate heat sinks. It contains systems design considerations for ultimate heat sinks such as the safety feature you must perform, the heat loads to consider when determining the performance of the ultimate heat sinks, and in the Reg Guide we also include meteorological conditions to consider in the design of ultimate heat sinks.

And there's also guidelines on how design against natural phenomenons and site hazards. And also in the revision we added additional guidance with respect to inspection and maintenance in testing of ultimate heat sink systems. And we also added guidance for water chemistry and micro-bio control.

So why are we updating this Reg Guide? I think it's obvious. The first thing is because it's outdated. The last revision was January 1976. A lot of things have changed and so we want to update the Reg Guide to incorporate lessons learned from operating experience in the last 40 years.

And we also want to update the Reg Guide so the guidance is consistent with the more current NRC guidance such as the Standard Review Plan. And we also want to include the changes that were made in the regulations in the last 40 years such as we added the maintenance standards, the maintenance rules.

So it's also a commitment from the staff to, like Brian mentioned, to update the Reg Guides on a regular basis to ensure that the guidance is current and accurate.

This slide just provides a summary of some of the changes that were made in the Rev 3. In the introduction section we added additional rules and regulations that were applicable to ultimate heat sinks. For example, in the current revision they only list GDC-2 protection against natural phenomenon and GDC-44 cooling systems as applicable regulation. In Rev 3 we added several other GDCs such as GDC-45 for inspection of water cool systems, GDC-5 in the

maintenance rules.

In the discussion section we revised and added additional design considerations. Some design considerations in the discussion section are repeated again in the regulatory position section which Jerry's going to talk about.

Some of the considerations we added include additional safety features that UHS must perform. We added some guidance with respect to performing transient analysis. I think we clarified some other issue with respect to our critical time periods.

And in the regulatory position section we made changes to the four existing regulatory positions primarily to clarify some of the positions that were confusing, and we also added several other additional design considerations based on operating experience. And then we added two new regulatory positions regarding inspections and maintenance of ultimate heat sinks and micro-bio controls.

Jerry, do you want to take off from there?

MR. PURCIARELLO: Yes. Thanks. In the current Regulatory Guide we have four regulatory positions, and in the new Regulatory Guide we maintain those four positions with some changes and we've

added, as Bruce said we've added two new regulatory positions.

The first two regulatory positions we had improvements and clarifications and we have some new guidelines in there. In the third and fourth regulatory position there's no change in content, we just made some minor editorial changes, and then we've added the fifth and sixth regulatory positions for inspection, maintenance and water chemistry and biological control.

In Regulatory Position 1 which is on system design considerations, we added some clarifications regarding the transient analysis. We added clarifications regarding whether you have, if you have two cooling towers are more that you have to include the effects of recirculation and interference.

And we also added clarification on how to select critical meteorological data when computing basically the real basic criteria for having ultimate heat sink that is the maximum intake water temperature to the plant and also the fact that it has to last for 30 days. And then also added system design considerations for fire resistance, about construction materials having to be fire resistant.

We added the requirement, the safety

related requirement of being able to remove the heat from the spent fuel pool. And then we've added some criteria regarding the active components. We added guidelines for manual actions if appropriate, but we've said that the active components should be automatically operated.

And then we've added some criteria for the inventory. We want our licensees to include boundary leakage because recently a licensee tried to exclude boundary leakage when it was significant leakage and said that the Reg Guide didn't cover that. So now it will. Next slide please.

And then Regulatory Position 2 regarding natural phenomena site hazards we made sure that the site hazards were associated with GDC-2. It didn't say GDC-2 before.

And then we added clarifications regarding the failure of manmade structures to include, we expounded upon the manmade structures to include reservoirs, dams, upstream and downstream dams, that is, including potential for flow blockage by debris based on industry experience. And then also added features associated with the potential changes in the ocean and river levels or lake levels, and that was based on a public comment that we received. And then

also based on experience we've added criteria for adverse conditions associated with icing and freezing of a water storage facility like the basin of a cooling tower.

And then we also added GDC-4 to the criteria for the ultimate heat sink that has to take into account pipe whip, water hammer and any type of dynamic effect. And then also based on industry experience we added the requirements that consider potential clogging of the suction flow paths because that's happened throughout the industry both here in the United States and overseas. Next slide please.

Okay, we've added, like I said before we've made some editorial changes to Regulatory Positions 3 and 4, but I won't discuss those because there's no content change to it. But Regulatory Positions 5 regarding inspection, maintenance and performance, this is based on current knowledge and experience. We decided that we had to add this Regulatory Position for maintenance and inspection.

I believe there was cases of cooling towers having excessive corrosion. You might recall back in 2006 a non-safety related cooling tower, Vermont Yankee, actually collapsed. It was a wooden cooling tower. Non-safety, it wasn't involved in the

ultimate heat sink but that was a consideration for including this regulatory position for inspection, maintenance and performance testing.

And then we've added also the criteria that if the dam or water control structure is within the jurisdiction of the licensee that it should be in the maintenance program, Reg Guide 1.160, the maintenance rule.

And then Reg Guide 1.27 we added since the subcommittee, and that's actually for inspection of all water control features or structures whether it's under the jurisdiction of the licensee or not within the jurisdiction of the licensee.

MEMBER SCHULTZ: Jerry, is Reg Guide 1.127, is that a relatively new Reg Guide? Or if not, is it recently updated?

MR. LIN: This Reg Guide is out for public comments. I think it's due currently out for public comments. It was issued January 2015 out for public comment.

MEMBER SCHULTZ: Okay, that's the stage it's in. Thank you.

MR. LIN: The current version is very old.

MR. PURCIARELLO: 1978.

MEMBER SCHULTZ: Thank you.

MR. PURCIARELLO: And then we felt the need to add Regulatory Position 6 based on current knowledge and experience and that involves water chemistry and microbiological control. Next slide please.

And in the Reg Guide we've, as the slide says the draft Reg Guide was published in 2013. We received comments from the public, ten from NEI, and some from the general public and anonymous also. We've resolved those comments and we put those in Reg Guide 1.27 as appropriate.

We had our subcommittee meeting back in March and -- next slide please -- and the subcommittee had some comments that I'm now going to address.

The subcommittee took exception to the phrase "reasonably to be expected" because they wanted some more specific criteria just as far as regards to natural phenomena and site hazards.

I don't know if you're aware, but back in 2012 there was a NUREG published, 2150. Is the committee aware of that? I don't know. But it involved a proposed risk management regulatory framework and it was commissioned by then Chairman Jaczko and chaired by Commissioner Apostolakis. It was again it was a proposed risk management regulatory framework. And

I'm reading from the executive summary here.

One of their findings was that the process for establishing the external hazard design bases does not use consistent event frequency or magnitude methods. And the recommendation for that was the NRC should reassess methods used to estimate the frequency and magnitude of external hazards and implement a consistent process that includes both deterministic and PRA methods. Considerations of the risks from beyond design basis events for external hazards should be included in the proposed design enhancement category.

So I guess to summarize that, what this study found that we really don't have any specific criteria for putting in some type of, you know, frequency or expected assessment of magnitude methods or frequency of any type of external design hazards. So we can't get more specific than that.

So what we suggest using is taking out the reasonably expected phraseology and using what GDC-2 uses and use the term "more appropriate combinations" as opposed to reasonably expected. And at this time we can't get any more specific than that. I think the staff or the NRC recognizes that this is an issue and that somehow, you know, I don't know what the

corrective action is and when this will be implemented, but we don't have any way of becoming more specific as far as talking about the magnitude and the frequency of external hazards.

MEMBER RAY: You are referring to these other Reg Guides?

MR. PURCIARELLO: Yes, and that's been mentioned as far as for seismic and for hurricanes. Yes, that's now in the Reg Guide.

CHAIR STETKAR: Jerry, now if this Reg Guide uses the term "appropriate combinations," does that mean the onus on the staff and a particular licensee to justify what is an appropriate combination for their site?

MR. PURCIARELLO: I would say yes.

CHAIR STETKAR: Okay.

MR. PURCIARELLO: I mean hopefully there will be some guidance based on deterministic methods and PRA that will come out sometime in the future that would be more --

CHAIR STETKAR: I know in Research, the risk assessment branch is looking at screening criteria in the context of risk assessments. And that's one issue that they're looking at is specifically screening criteria. And again it's

focused in the context of risk assessment, not necessarily something that would fall into this Regulatory Guide.

But as you mentioned they are related in sense because there is a frequency and there's a compounding effect, you know, of certain types of hazards. So I just wanted to make sure I understood how appropriate combinations would be considered, you know, among the staff and the licensee if a particular licensee came in and said, well, you know, I want to make a change to something.

MR. PURCIARELLO: Well, we used a higher tier document and that is GDC-2. We just used the word of that and you can't get any more specific than that at this time.

MR. LIN: I know for specific hazards there are standards that, I'm aware of a flooding. There's an ANS standard that lists appropriate combinations for combined events.

CHAIR STETKAR: Core flooding is, flooding a bizarre issue that's being addressed a lot under, external flooding anyway which we're concerned about your being addressed under post-Fukushima initiatives.

MR. PURCIARELLO: Next slide please. This slide shows one of the subcommittee's comments

regarding the word "prudent." The word "prudent" didn't seem to have much meaning to it, very subjective. This is in regards to the prudency of inspecting dams and water control structures that are outside the jurisdiction of the licensee or applicant.

So as we previously stated on another slide before this, we've added Regulatory Guide 1.27, "Inspection of Water Control Structures Associated with Nuclear Power Plants" to be used. We should have had this before. I guess we became more aware of it trying to answer this subcommittee comment that water control structures, dams included, should be under the guidance of Reg Guide 1.27 for whether the structure is controlled by the licensee or not by the licensee.

MEMBER RAY: I think this is a good change. The prudent part was troublesome to me.

MEMBER RICCARDELLA: We had some discussion yesterday about the use of the words "should" and "shall" and "may" in documents such as this. Is the "should" appropriate here?

MEMBER RAY: I believe so. Another word you might choose is "must," but I don't think that's appropriate for regulatory guidance. "Shall" is equivalent, synonymous with "must," I think. But I think regulatory guidance, "should" is appropriate.

That's my judgment.

MR. PURCIARELLO: They're not required to comply with this. If they come up with an alternative that's acceptable to the staff they can deviate from a guideline. They can't deviate from a regulation.

CHAIR STETKAR: I'm a little bit, I'm looking at some notes. We had a subcommittee meeting on Reg Guide 1.127 and I don't remember what it was. I guess my notes are from February of 2012. And it seemed to be some fuzziness in that Reg Guide.

Now you pointed to that Reg Guide for inspection requirements, so I'm trying to close the loop here. And when we asked in the context of that Reg Guide how would the inspection apply to owners and operators of upstream dams that were not part of the licensee's organization, and then I'm reading responses to well, you know, the NRC inspects some nuclear power plant dams. The licensees inspect some nuclear power plant dams.

But the scope of that particular Reg Guide does not include upstream dams whose failures may cause flooding at the site unless those dams are also required for heat sink retention. So it says -- these are my notes. This is not a quote from the Reg Guide itself. From my notes from the staff back in February

2012, it says the NRC and licensees rely on inspections by other state and federal agencies for those dams.

The concern obviously is if you have an upstream or downstream dam outside of your control as a licensee what assurance do we have indeed that those dams are being inspected? And it's not clear to me necessarily that pointing from this Reg Guide to 1.127, which hasn't been issued yet, but pointing to that solves the necessary concerns. So that's a few because I just want to point to some other guidance.

MR. PURCIARELLO: Can I read what this Reg Guide 1.127 says?

CHAIR STETKAR: 1.127?

MR. PURCIARELLO: Yes.

CHAIR STETKAR: Or 1.27?

MR. PURCIARELLO: 1.127.

CHAIR STETKAR: Okay, good. Thanks.

MR. PURCIARELLO: Okay. It says, "This guide applies to water control structures, for example, dams, reservoirs, conveyance facilities specifically built for use in conjunction with the nuclear power plant and whose failure could cause radiological consequences adversely affecting the public health and safety."

So in other words I read that to mean that the dam has to be built in conjunction with the nuclear power plant. No, it just can't be, I don't think a licensee can just, or an applicant can just say I want to use that dam. The dam has got to be built in conjunction with the nuclear power plant.

In addition -- I'm reading again. In addition, the structure was built wholly or in part for the purpose of controlling or conveying water for either emergency cooling operation or flood protection of the nuclear power plant.

MEMBER RAY: Let me interject something here. When I read what you had done recognizing what Chairman Stetkar just said and recalling that, I thought you were referring to details on inspection and performance monitoring meaning the methodology as opposed to this describes an existing requirement.

I'm speaking of 1.127. Trying to say it another way, and I'm going to ask again is this your intent. I thought this was a vehicle for defining how to as opposed to saying, oh by the way this describes what you must do. And that goes back to what Pete said which is that the "should" is what's being created in this Reg Guide or exists in this Reg Guide, not the "should" doesn't come from 1.127 when we're

talking about what you're talking about here. It's just the methodology. Now that was my reading of it.

MR. LIN: I think with the intent of the staff with the first sentence basically tell you, you should inspect the water control structures for changes in structure, hydraulic and foundations, and then we refer to the Reg Guide for specific guidance. And also I'm reading from the draft.

MEMBER RAY: You're not inspecting by the way, excuse me, you're not inspecting on the basis of verifying the adequacy but you're looking at changes.

MR. LIN: Right.

MEMBER RAY: Okay.

MR. LIN: Also in the draft, changes to Reg Guide 1.127, basically it states that embankments and other appurtenant structures associated with or part of water control structures addressed by this Reg Guide are those typically built to provide and protect ultimate heat sinks. It's in there.

So I think it's appropriate to --

MEMBER RAY: But again the Reg Guide 1.127 we understand is more constrained than would encompass a dam failures which could result in flooding, which is what we're talking about here. It's more constrained. It's talking about things that have been

built to provide for the ultimate heat sink as opposed to things that could fail and result in not the loss of the ultimate heat sink but flooding. That's what Sherman was asking about I thought.

CHAIR STETKAR: It's both. I hate all of this pigeonholing of things because people think about flooding as some rise of water level. I think of a dam failure as causing a mountain of water coming down through some valley. That mountain of water will allow level to rise, it also might sweep away things like your intake structure. It also might clog your intake structure with things like, oh, whatever towns were upstream.

So I don't want to get into this argument about whether it's a dam failure that causes a flood which triggers certain things or a dam failure that might drain away an ultimate heat sink which would be a downstream dam. I'm concerned about dam failures that may affect the site, the ultimate heat sink and the intake structure being part of that site.

MEMBER SCHULTZ: What I've heard, John, is you introduced this by saying we want to check and see that the loop was closed. And what I'm hearing is that the loop is very small and incorporates what has been established as the ultimate heat sink and what

structures were used to do that. It doesn't do what you're describing and that is examine structures that may affect the site and the ultimate heat sink beyond that. And so we just need to recognize that.

CHAIR STETKAR: Yes. And I don't know what the context. I mean, you know, 1.27, because it is focused on the ultimate heat sink might not be the vehicle. It might be 1.127. But we just need to make sure that we understand that distinction.

MEMBER RAY: Yes, I think that's a good point.

MR. LIN: I think Regulatory Position 2 restates that ultimate heat sink should be capable of withstanding the failure of reservoirs, dams, and other manmade water retaining structures both upstream and downstream. And we're referring to this Reg Guide for the routine inspection programs.

CHAIR STETKAR: The only question is how far upstream does that zone of influence extend? Because in a very narrow interpretation of 1.127 it extends only to the dams that were built for the purpose of that nuclear power plant. It doesn't extend to the other dams that might be withholding, you know, the greater portion of the watershed of, you know, 50,000 square miles or something like that.

MEMBER RAY: Yes. No, I think that's a good point and it's clearly the case that this 1.27 isn't attempting to speak to the larger issue that you've described. 1.127 also is constrained by apparently the limits that we've talked about. I think perhaps we have a larger concern that we need to track going forward. I'm not wanting to dismiss it at all.

CHAIR STETKAR: We've addressed what would link into some of the post-Fukushima flooding stuff also, so we have that thing.

MR. PURCIARELLO: Next slide, please. And then another issue was the issue of the design of active components in the ultimate heat sink and that we say that they should be automatically start or open/close automatically by design.

There was some confusion in the last, at the subcommittee meeting on whether when we refer to manual action was it because the automatic features failed or because they weren't designed into the system. And we're saying that if it's an active component it should operate automatically per design and then if it doesn't obviously it has to be operated manually, and that's subject to Reg Guide 1.62 which is on Manual Initiation of Protective Actions and that

the manual actions will be judged by the staff on whether it's allowed in that application for operation of the UHS.

CHAIR STETKAR: I think also during the subcommittee meeting we mentioned that in general -- previous session I kind of made this point, but it was a closed session so I'll do it again in an open session. That the guidance for evaluating feasibility and associated uncertainties with manual actions has kind of evolved over time.

And some of the best guidance in my opinion anyway is NUREG 1852. Now people will say, well that has the word "fire" in the title of it, but it's actually the basic concept of how you look at how much time is available, how much time is required to perform an action.

So if you have 60 minutes is available and it takes 59 minutes to perform the action that gives you one minute of margin and then there's uncertainty about that. So you look at the feasibility in the context of time available, time required and uncertainties in both of those parameters and then look at the margins. That concept is not in Reg Guide 1.62.

We made comments on that when we had our

subcommittee meeting on Reg Guide 1.62 current revision back in, my notes are February, no, it was even December of 2009. That was a couple years after NUREG 1852 was issued.

So I think some of the comments we had at the subcommittee meeting is this assessment of the feasibility of these manual actions perhaps ought to be thought of in that context rather than the more deterministic prescriptive context of Reg Guide 1.62.

MEMBER RAY: The example, and it's just an example, John, of course here is make-up water, which presumptively not guaranteed but presumptively time isn't an issue. But that's just an example.

CHAIR STETKAR: That's just an example and that doesn't change the way you think about it. I mean providing the fact time is an issue because eventually you're going to run out of water and you have a certain make-up rate and a certain, you know, use rate, and who knows, you know, how long. If it's simply pushing a button to start a pump that's one thing. But that doesn't change the concept of the way you think about it. I mean it might be very easy to demonstrate feasibility using that methodology. That doesn't say that you ought not to think about the methodology. And as you said that's only one example.

MEMBER RAY: It is just one example. I guess the premise is as I looked at this anyway, was that the license design rather than this Reg Guide determined what needed to be automatic and what could be manual. And that this wasn't attempting to make that choice. You're pointing out that choice has to be made at some point and it needs to take into consideration --

CHAIR STETKAR: I think the observation was that some plants rely on operator, you know, manual operator actions. That it's not a backup to, failure of an automatic function. This clarifies that specific uncertainty. But some plants, you know, do rely on operator actions for, one action is replenishment of, you know, a closed basin from another supply. There could be others. I don't, you know, I'm not familiar with every plant.

MR. PURCIARELLO: Let me give an example. How about a safety related cooling tower where the fans have to start right away? Well, in that particular case, if they came in with a design that the operator would manually start those fans we wouldn't approve that. Or if a valve has to open to get water up to the cooling tower that would not be approved unless it's -- so we're saying in the Reg

Guide, and it's a guidance only. It's not saying that they should start automatically.

The case of the make-up water obviously, you know, that's a long term effect and we have no problem, you know, if that's going to be done a couple days from after the accident that they have to replenish water. It's supposed to last 30 days. If it doesn't last 30 days then they have to replenish and it's not going to be right away, that would be a manual action that would be, you know, acceptable. And some are context to that. We're saying if something has to start or isolate it should be automatic.

CHAIR STETKAR: No, I understand that. What I'm talking about is the principle. You're saying manual. You know, the Reg Guide provides guidance for manual initiation of protective actions, and I'm saying that that Reg Guide is out of date compared to the way that we think about demonstrating feasibility of those actions.

MR. PURCIARELLO: Okay, then maybe we should just take that out then. Are you suggesting we should take that, we could take it out.

CHAIR STETKAR: Not a role as an individual member of the ACRS to necessarily suggest

the wording, I'm just trying to alert you to the fact that there's kind of an evolving notion of how one demonstrates feasibility of these manual actions. And that Reg Guide 1.62, at least the latest version I have, was a snapshot of that in 2010. And as I said, we had comments on that Reg Guide at that time, but unfortunately they were ignored.

MR. PURCIARELLO: We did ask our human factors engineers here, and they said Reg Guide 1.62 would be appropriate here.

CHAIR STETKAR: Okay. And that's your decision. Thanks.

MR. PURCIARELLO: Next slide, please. Then the last issue --

CHAIR STETKAR: Jerry, just one thing. Be careful of those papers. Once we have the mics on they're really sensitive.

MR. PURCIARELLO: Sorry. The last issue we're going to talk about now is addressing the final subcommittee comment regarding the applicability to passive plants. And the staff concluded that this Reg Guide should apply only to plants with active safety systems for the reasons stated there. That's there, you know, that passive plants are judged on a case by case basis and it doesn't appear to be beneficial to

develop a Regulatory Guide for passive plants at this time. Okay, next slide please.

So in conclusion, this Reg Guide has been revised to address current regulations and lessons learned from operating experience. It provides the necessary guidance for a licensee to design an ultimate heat sink. We've reviewed public comments and ACRS comments and we've incorporated comments appropriately, and we believe that Reg Guide 1.27 is now ready for final publication.

MEMBER RAY: Are there other questions for staff from members?

MEMBER SKILLMAN: Harold, this is Dick.

MEMBER RAY: Yes, go ahead, Dick.

MEMBER SKILLMAN: Staff, thank you for presentation. We'd just like to suggest on your draft Reg Guide, Rev 3, Page 4, top paragraph described in the last sentence, heat of the spent fuel pool. I know a number of plants in the country actually have pools, plural, and that would be my only comment.

MEMBER RAY: Thank you, Dick.

MEMBER SKILLMAN: Yes, sir. And Harold you convinced me on the appropriateness of not attempting to combine passive and not passive. So I'm with you. Thank you.

MEMBER RAY: Thank you. Anything else? I believe the phone line is now open and so we invite any comments from members of the public who have been listening in. Hearing none, I'll turn it back to you in good time, Mr. Chairman.

CHAIR STETKAR: And I am duly impressed and thankful. I'd like to thank the staff and also thanks for taking our comments from the subcommittee at heart. We appreciate that. That's one of the reasons why we have the subcommittee meetings to try to get some of that input. So thank you very much.

If nothing else, we are in fact recessed for lunch and we come back to work on our own reports. We don't have anything else on our agenda.

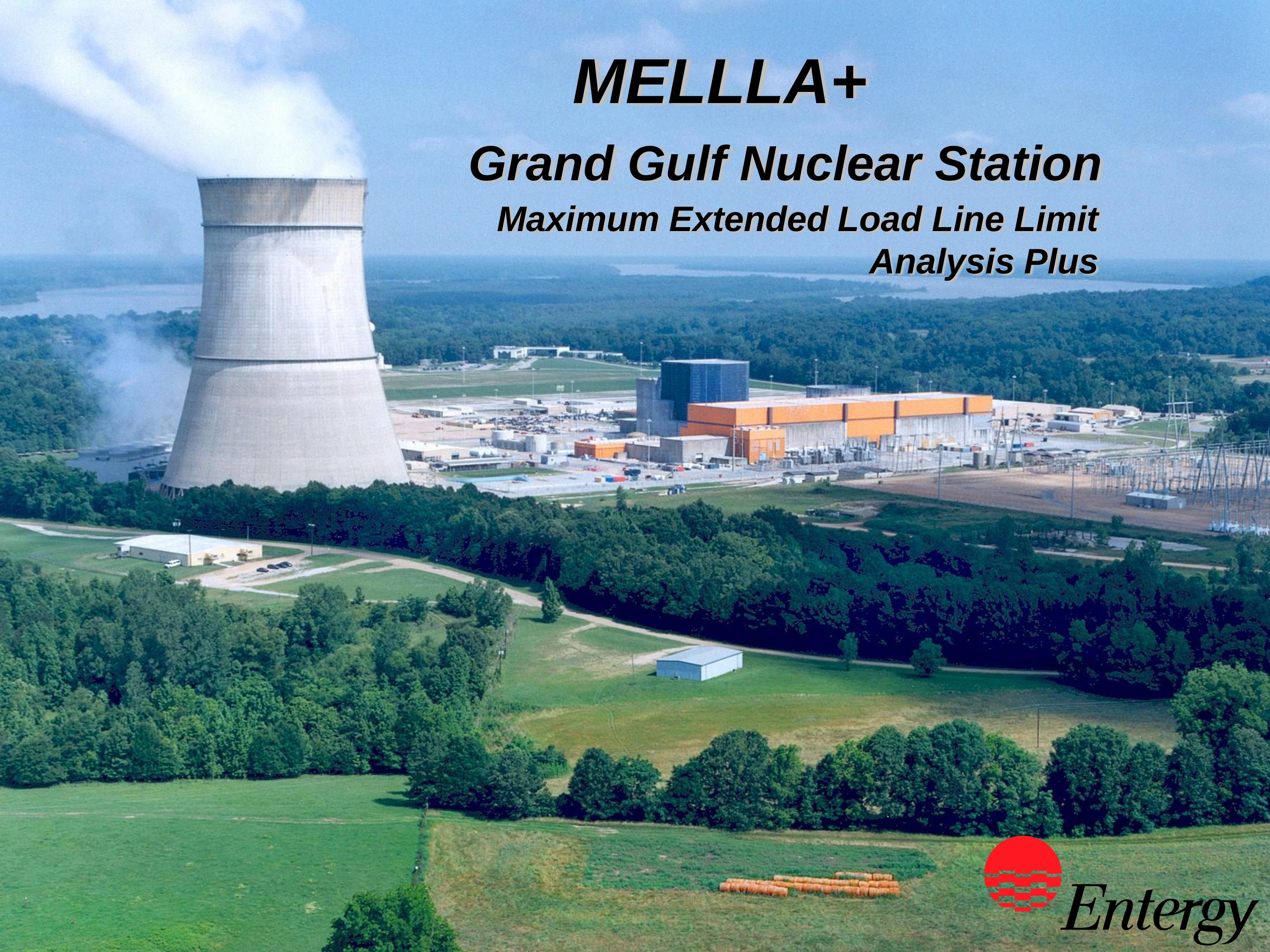
For the purposes of anyone who might be on the bridge line, our agenda had one more topic listed today and that was, look for the title because I can't remember anything. Well, it's the update on the Reactor Oversight Process. We had to postpone that because of Member Skillman's illness, and we will reschedule that for a later full committee meeting. So we are now done with our formal presentations and we are recessed for lunch. Come back at 1 o'clock.

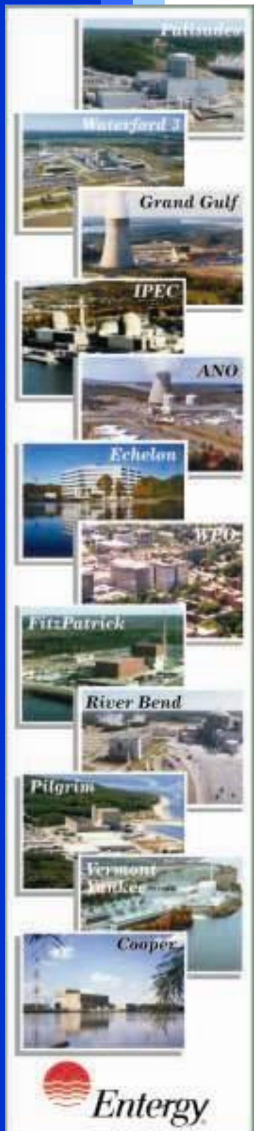
(Whereupon, the above-entitled matter went off the record at 11:45 a.m.)

MELLLA+

Grand Gulf Nuclear Station

Maximum Extended Load Line Limit Analysis Plus





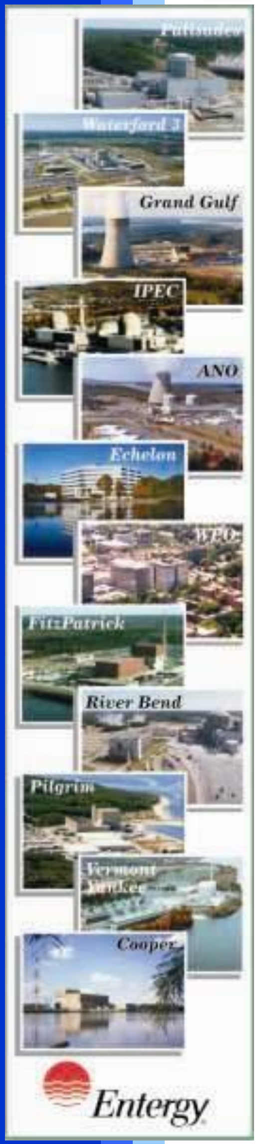
Advisory Committee on Reactor Safeguards

Grand Gulf Nuclear Station

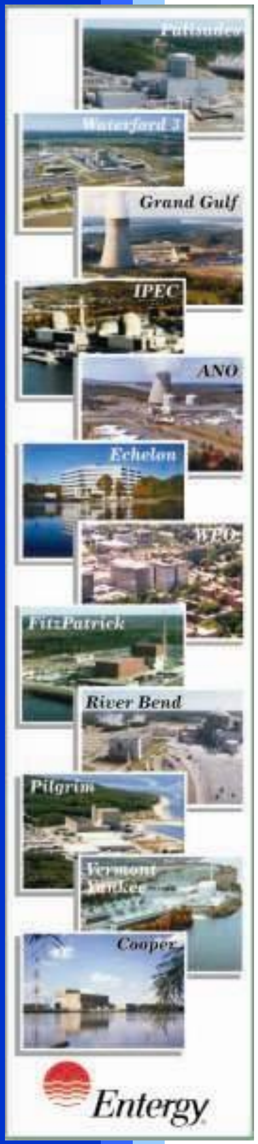
Maximum Extended Load Line Limit Analysis Plus (MELLLA+)

May 7, 2015

Entergy ACRS Committee Presenters



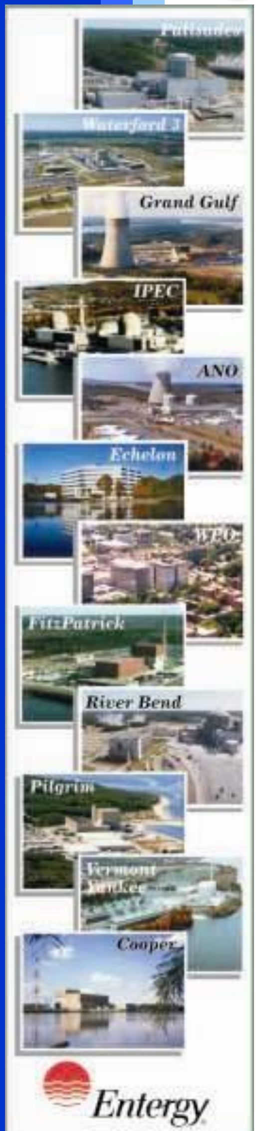
- **Bryan Ford– Sr. Manager, Fleet Regulatory Assurance Entergy**
- **Greg Broadbent– Supervisor, Fleet Nuclear Analysis Entergy**
- **James Nadeau – Manager, GGNS Regulatory Assurance Entergy**
- **Ricky Liddell – Supervisor, GGNS Operations Training Entergy**



AGENDA

- **Overview and Benefits**
- **Safety Analysis Methods**
- **Simulator Video**
- **ATWS-I Analysis**
- **License Condition**

Grand Gulf Nuclear Station Overview

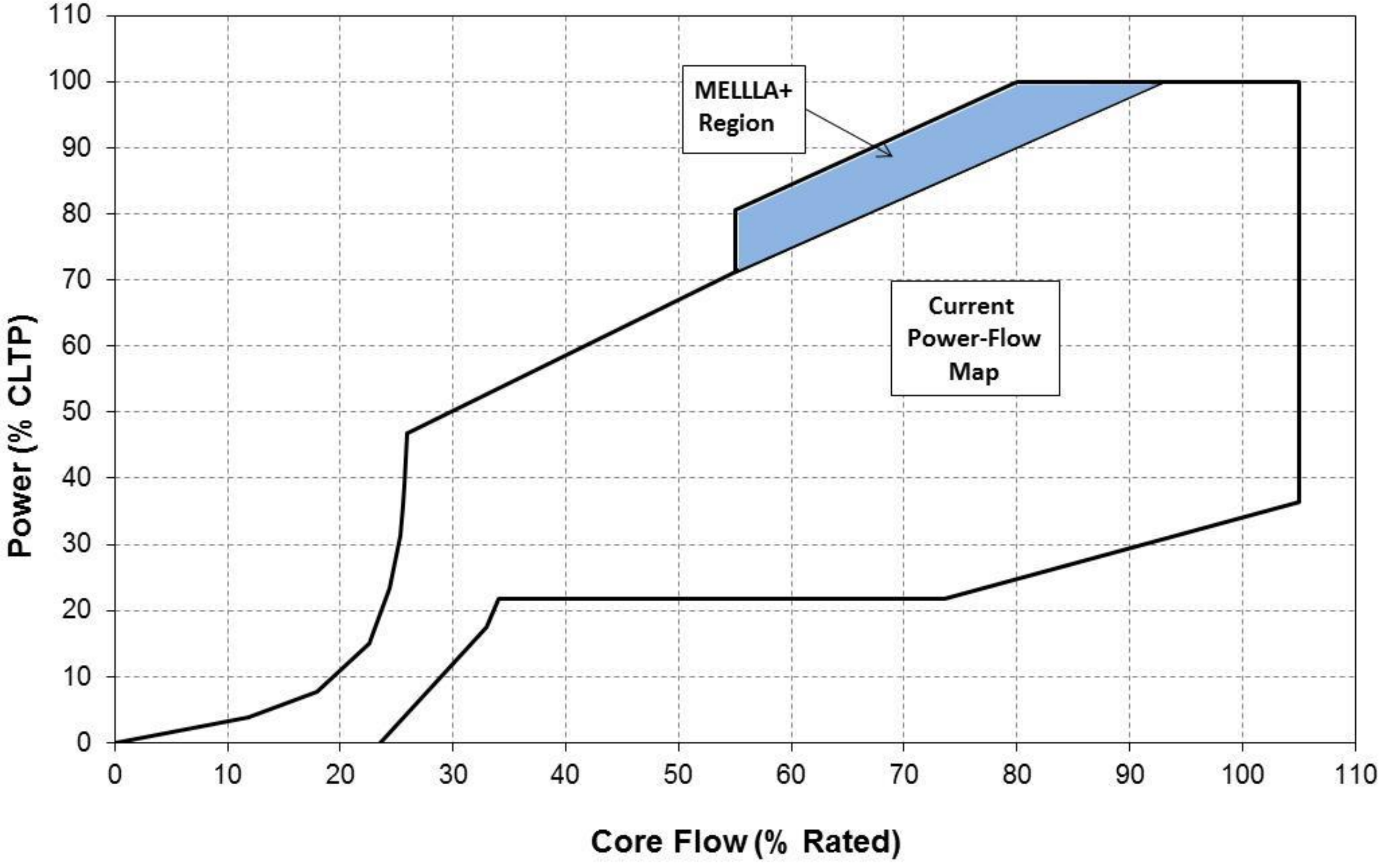


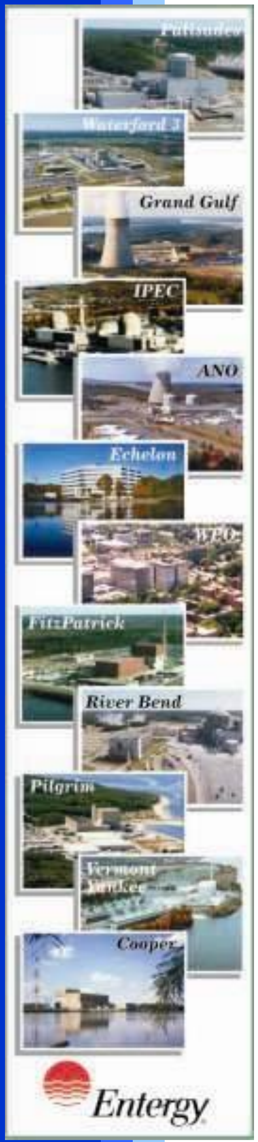
- Operating License Issued November 1, 1984
- Commercial Operation Began July 1, 1985
- GE BWR 6 - Mark III Containment

OLTP Limit	3833 MWt
CLTP Limit	4408 MWt

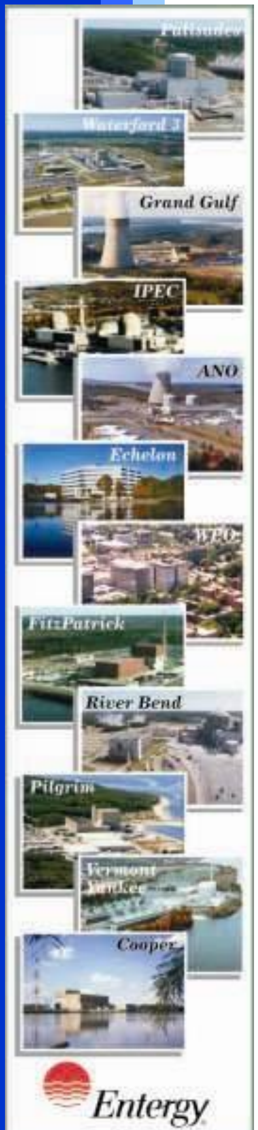
- MELLLA+ Offers Improved Operational Flexibility
  - Reduced Reactivity Manipulations
  - Reduced Operator Challenges
  - Reduced Enrichment Requirements

Proposed Extended Operating Domain

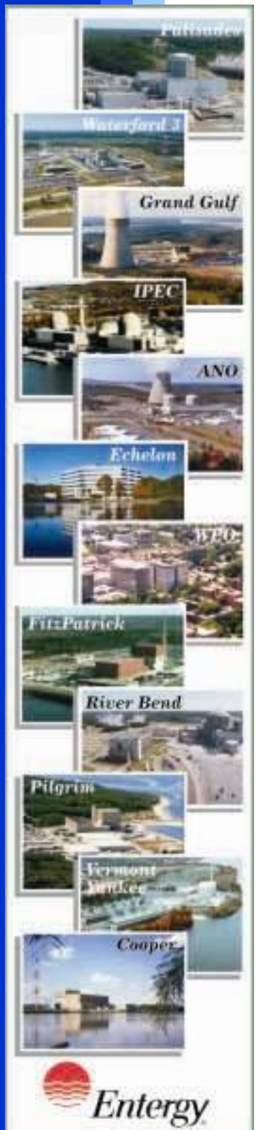




Safety Analysis Methods



- **Met all 80 Limitations and Conditions**
  - **Methods LTR NEDC-33173 (24 Limitations)**
  - **MELLLA+ LTR NEDC-33006 (52 limitations)**
  - **DSS-CD LTR NEDC-33075 (4 limitations)**
  - **TRACG LTR NEDC-33147 (0 limitations)**
- **Two Audits:**
  - **GEH April 2014**
  - **GGNS October 2014**

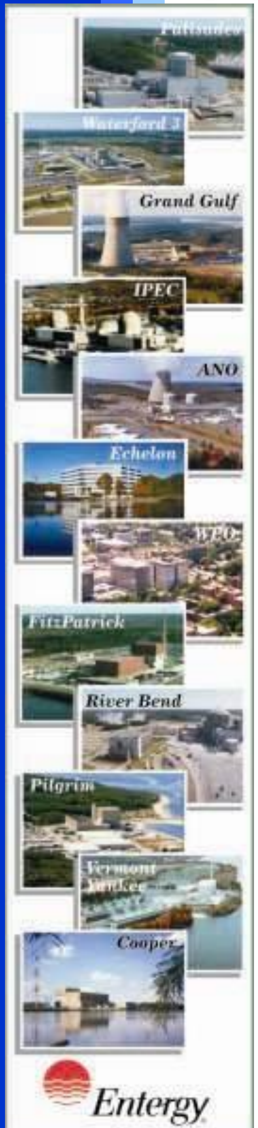


GGNS-Specific Evaluations
ATWS Analysis

Evaluation of MELLLA+ LTR NEDC-33006P-A

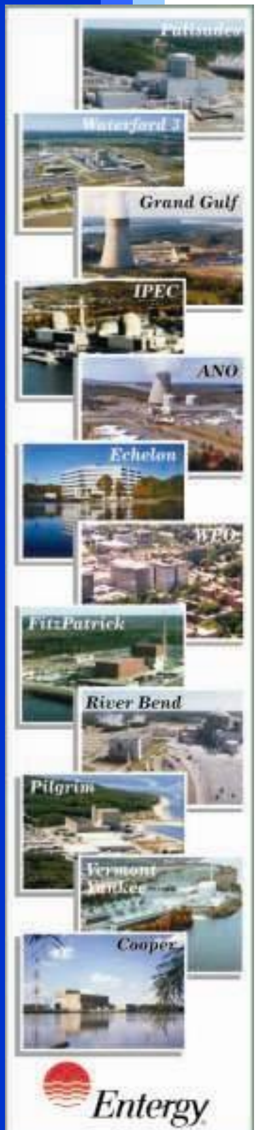
– **Operation in the MELLLA+ Region Results in a Higher Power Level in the Event of an ATWS**

– **Operator Action to Initiate Reduction of Reactor Water Level Within 90 Seconds of ATWS Identification**



ATWS Time Critical Operator Actions

TCOA	MELLLA+
Initiate Reactor Water Level Reduction	90 Seconds
Initiate Standby Liquid Control Injection	300 Seconds
Initiate Suppression Pool Cooling	660 Seconds

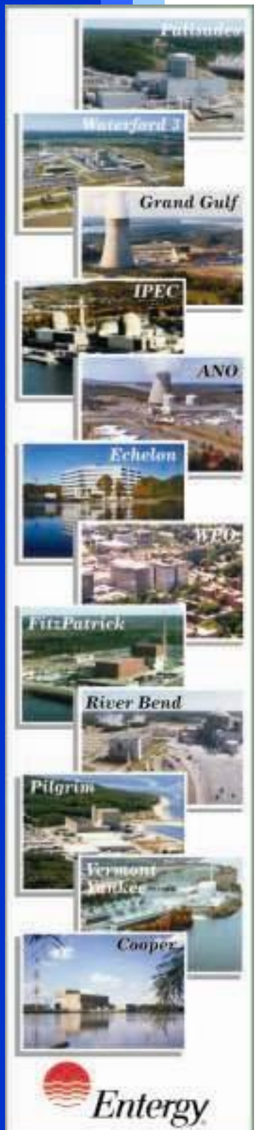


Simulator Video

– **Audit confirmed time to initiate water level reduction was less than 90 seconds.**

– **Benchmark of Monticello confirmed that Operators can initiate within 90 seconds.**

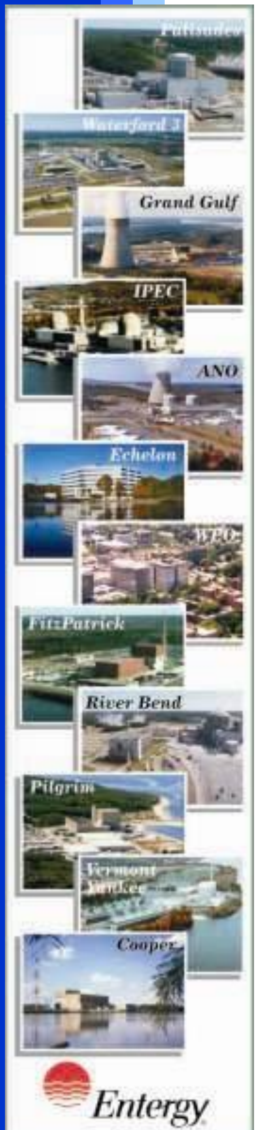
– **Operator Training Programs and initial actions are comparable.**



ACRS Sub-Committee Requests

- **Operator Action Times**
- **TRACG Tmin (minimum stable film boiling temperature)**
- **Peak Cladding Temperature Margin**

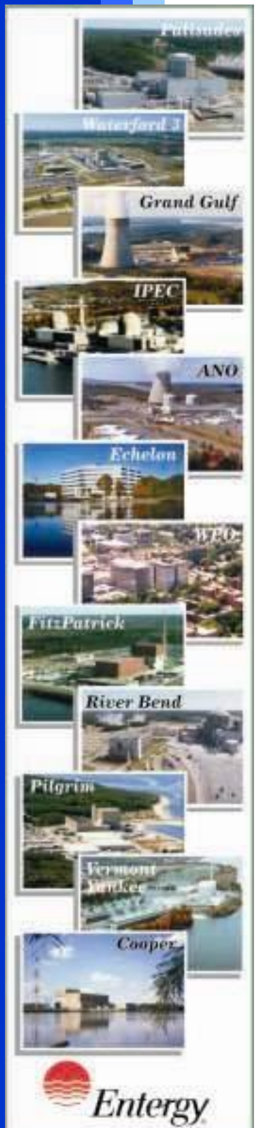
ATWS-I PCT Margins



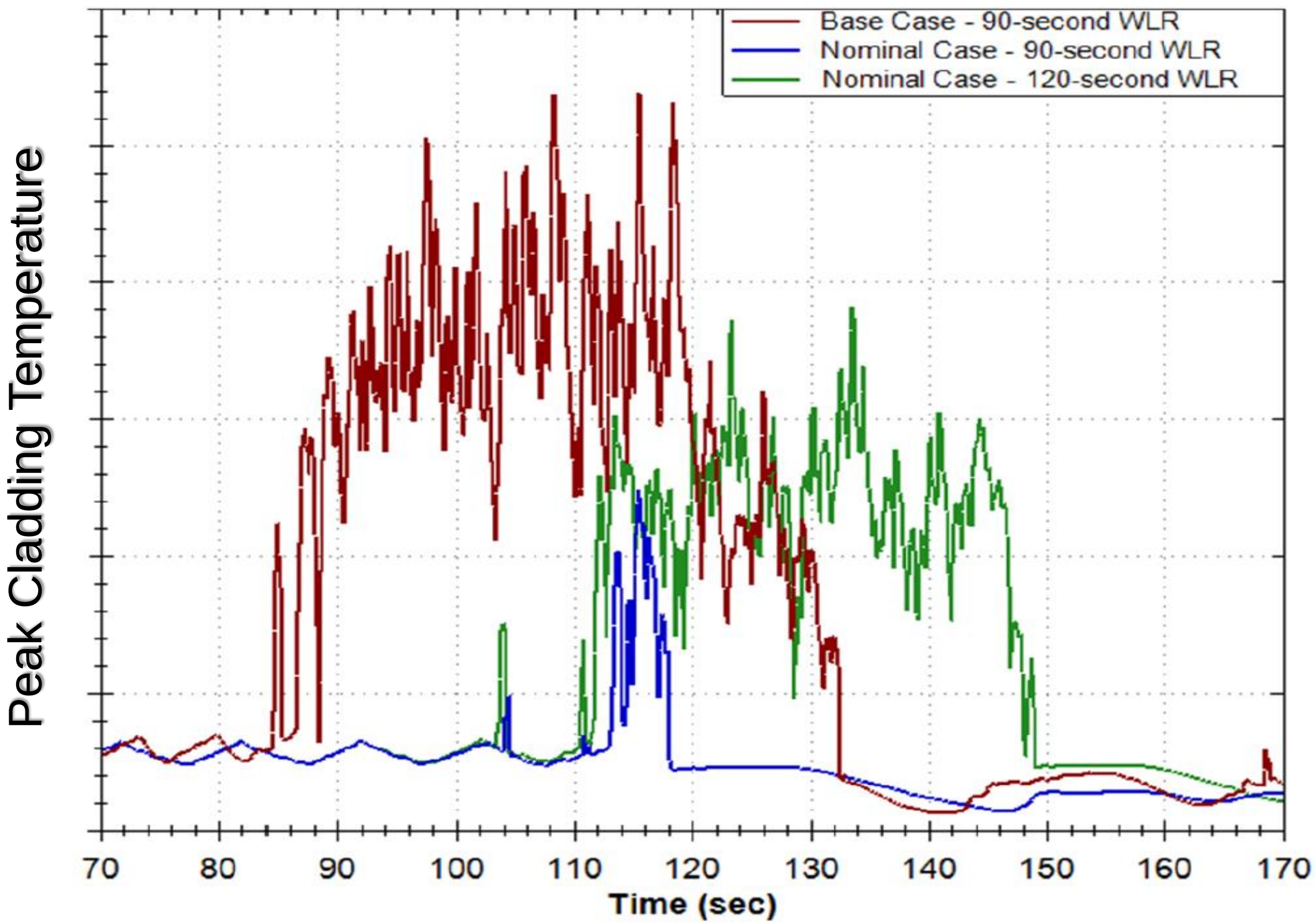
- **ATWS-I Analysis is best-estimate**
- **GGNS runs applied conservative values in some sensitive inputs**
  - **Minimum core flow**
    - **Assumed 80% although the core is designed with 85%**
  - **Rod peaking**
    - **Assumed on 95% LHGR limit although the core is designed with >10% margin**
  - **Post-ATWS Feedwater Temperature Transient**
    - **Assumed bounding (faster) drop than expected to increase reactivity insertion**

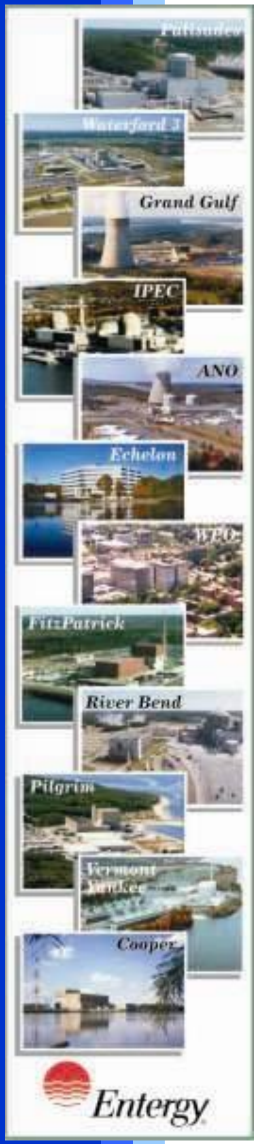
– **Sensitivity evaluations were prepared to quantify the margin**

Margin Analysis



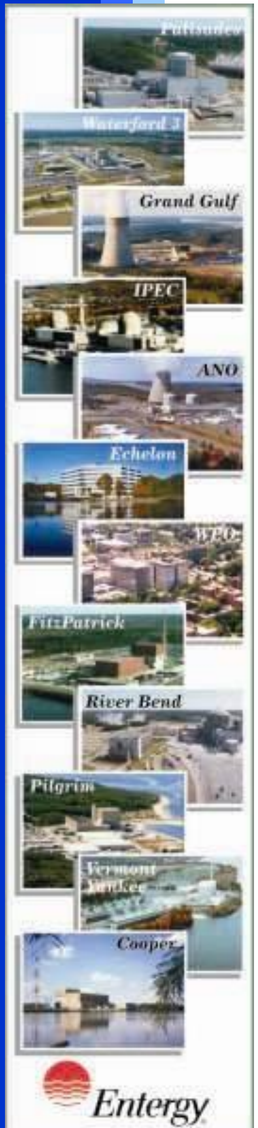
Results of Sensitivity Runs





License Condition

- **License Condition to Ensure Time Critical Operator Actions**
  - **Validation of Time Critical Actions Will Confirm Crew's Ability to Perform**
  - **Results Will Be Reported to NRC**



Conclusions

- **GGNS Can Operate Safely in the MELLLA+ Region**
  - **Quality of Analysis**
  - **Quality Training**
  - **Time Critical Operator Actions Will Be Met**

Regulatory Guide 1.27
Ultimate Heat Sink for Nuclear Power Plants
(Revision 3)

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ACRS Full Committee Meeting
May 7, 2015

U.S.NRC
United States Nuclear Regulatory Commission
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Agenda

- Overview of RG 1.27
- Reasons for Revision
- Summary of Revisions
- Technical Revision
- Addressing Public Comments
- Addressing ACRS Subcommittee Comments
- Conclusions

Overview of RG 1.27

- The ultimate heat sink (UHS) is the system of structures and components and associated water supply credited for functioning as a heat sink to absorb reactor residual heat and essential station heat loads after a normal reactor shutdown or a shutdown following an accident or transient including a loss-of-coolant accident (LOCA)
- The UHS performs three principal safety functions:
  - Dissipation of residual heat after reactor shutdown
  - Dissipation of residual heat after an accident such as a loss-of-coolant accident
  - Dissipation of maximum expected decay heat from the spent fuel pool

Overview of RG 1.27

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- Describes applicable rules and regulations related to UHS
- Contains systems design considerations for UHS
  - Provides meteorological conditions considered in the design of UHS
- Contains natural phenomena and site hazards design for the UHS
- Provides guidance for inspection, maintenance and system performance testing
- Provides guidance for water chemistry and micro-bio control

Reasons for Revision

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- Outdated
  - Last revision: January 1976
- Need to update RG 1.27
  - New reactor applications
  - Revisions in regulations
  - Lessons learned from operating experience
- NRC Staff Commitment to Commissioners in 2006 (ML060760667)
  - Update RGs where appropriate to go along with the SRP update associated with new reactor applications
  - Commitment to update RGs on a regular basis

Summary of Revisions

- The introduction section was revised to include applicable rules and regulations
- The discussion section was revised to incorporate/update relevant design considerations for UHS
- Changes to the 4 existing regulatory positions and added two new regulatory positions

Summary of Revisions

Regulatory Position (1976)	Regulatory Position (2015)
1. System design and meteorological conditions	1. System design and meteorological conditions
2. Natural Phenomena-hazards	2. Natural Phenomena-hazards
3. Defense-in-depth	3. Defense-in-depth
4. Technical Specifications	4. Technical Specifications
	5. Inspection, maintenance, & testing
	6. Water Chemistry and Micro-bio controls

Technical Revision

Regulatory Position (RP)1 – System Design Considerations for the UHS

- Added clarifications regarding transient analysis for UHS where the water supply may be limited
- Clarified the critical time periods and the bases and procedure used to select critical meteorological data
- Added the following systems design considerations:
  - Construction material should be fire resistant
  - Heat load that are important to safety should be included in determining the UHS thermal performance (spent fuel pool)
  - UHS active mechanical component should automatically start to support DBA heat loads
  - UHS inventory to support 30 day period for UHSs should account for potential water losses

Technical Revision

Regulatory Position 2 – Natural Phenomena and Site Hazards

- The UHS should be capable of withstanding the most severe natural phenomena expected at the site in accordance with GDC 2
- Added clarifications regarding failure of manmade structural features
- Added the following site hazard design considerations:
  - Potential changes in ocean, river, or lake levels
  - Potential for adverse environmental conditions such as icing and freezing of the UHS water storage facility
  - The effects of pipe whip, jets, energy line breaks and dynamic effects
  - Potential clogging of suction flow paths

Technical Revision

RP 5 – Inspection, Maintenance, and Performance Testing (new)

- Inspection and maintenance program should be established for the UHS system piping, structures, and components (detection of corrosion, erosion, protective coating failure, silting, and bio-fouling).
- Dam or other water-controlling structure and connecting piping systems within the jurisdiction of the licensee should be included in the Structures Monitoring Program in accordance with RG 1.160 and the Maintenance Rule. RG 1.127, "Inspection of Water-Control Structures Associated with Nuclear Power Plants" provides more details on inspection and performance monitoring of water-controlling structures.

RP 6 – Water Chemistry and Microbiological Control (new)

- The quality of the water used in cooling towers, spray ponds, and heat exchangers should be considered in the design and operation of the UHS.
- Redundant and infrequently used cooling loops should be flushed and flow tested periodically at the maximum design flow to ensure that they are not fouled or clogged.

Addressing Public Comments

- The draft RG (DG-1275) was published for public comment September 2013

- Comments received from:
  - NEI (10), General Public (1) & Anonymous (2)

- The comments were evaluated by the staff and incorporated into the draft RG 1.27, revision 3, as appropriate

Addressing Subcommittee Comments

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- When describing natural phenomena and site hazards, the RG uses terms such as "reasonably be expected to occur during the plant lifetime" and "reasonable probable combinations of less severe natural phenomena". The ACRS questioned this terminology as too vague and asked the staff to look into screening criteria for external hazards

- Proposed Staff Response:
  - NUREG 2150," A Proposed Risk Management Regulatory Framework," dated April 2012 found: The processes for establishing the external hazard design bases do not use consistent event frequency and magnitude methods and recommended that the NRC should reassess methods used to estimate the frequency and magnitude of external hazards and implement a consistent process that includes both deterministic and PRA methods.
  - The staff has decided not to include screening criteria for external hazards in RG 1.27. Appropriate guidance and criterial can be found in other RGs such as RG 1.59 "Design Basis Flood for Nuclear Power Plants" for flooding and RG 1.221 "Design-Basis Hurricane and Hurricane Missiles for Nuclear Power Plants" for hurricane wind speeds or when the recommendations of NUREG 2150 are implemented.
  - The staff proposes to delete "reasonably be expected" and to replace "reasonable probable combinations" with "appropriate combinations". The use of the term "appropriate" is consistent with the terminology used in GDC 2.

Addressing Subcommittee Comments

- In the discussion, the RG states that "it would be <u>prudent</u> for licensee to ensure other water controlling structures affecting the safety of the site are being monitored under another program such as…" The ACRS questioned the use of the word <u>prudent</u> rather than saying something stronger such as the measures being applied to these other structures.

- Proposed Staff Response – The staff has revised the sentence to read "<u>Inspection and monitoring of dam or other water control structure should be conducted to ensure that changes in structural, hydraulic, and foundation conditions can be detected. Regulatory Guide 1.127, "Inspection of Water-Control Structures Associated with Nuclear Power Plants" provides more details on inspection and performance monitoring of water-controlling structures</u>."

Addressing Subcommittee Comments

- In Regulatory Position 1.j, with respect to auto start of mechanical component, the sentence is confusing, more guidance should be provided regarding operator actions.

- Proposed Staff Response – The staff has revised the sentence to read "UHS mechanical components, such as pumps, valves, and cooling tower fans, should automatically start and open/close as appropriate to support DBA heat loads. If the UHS mechanical component does not incorporate design features that automatically start and open/close components, operator actions are required to support its intended safety function. For example, placing UHS safety-related makeup water in service to the UHS cooling tower may require operator actions to start makeup pumps to satisfy the 30 days UHS water inventory. RG 1.62, "Manual Initiation of Protective Actions" provides guidance for manual initiation of protective actions."

Addressing Subcommittee Comments

- The guidance provided in RG 1.27 Rev 3 is applicable to plants with active safety systems and does not apply to plants that utilize a passive containment cooling system as their UHS. The ACRS asked about UHS review guidance for passive plants and whether the guidance for passive plants should be included in RG 1.27.

- Proposed Staff Response - Passive designs have unique attributes and have not lent themselves to a common review procedure. The staff has reviewed these designs on a case-by-case basis and does not see the benefit in developing a regulatory guide at this time.

- Other comments have been evaluated and incorporated into the RG as appropriate

Conclusions

- RG 1.27 has been revised to address current regulations and lessons learned from operating experience since the guide was last revised in 1976
- Revised RG 1.27 provides necessary guidance for nuclear power plant licensees and applicants to use to establish UHS features of plant systems required by NRC rules and regulations
- Public comments received and addressed
- RG 1.27 ready for final publication

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BACKUP SLIDES

Public Comments & NRC Response

Public Comment	NRC Response
Background discussion regarding design considerations for UHS is too prescriptive, with some elements that may not have an established or NRC endorsed mechanism to evaluate, and new design inputs that may belong to 'beyond design basis' considerations, a process still in regulatory development. For example, "consider the effects of climate changes that might occur over the design life of the facility", etc. What would be the criteria & methodology to quantify? Moreover, the Fukushima Flooding Task Force is working with NRC on various guidance on dam failures, etc. and language here is duplicative of other guidance.	The staff partially disagreed with this comment. In Rev 3 of draft RG 1.27, the staff added discussions on system design considerations for the UHS, clarified the meteorological conditions to be considered and considerations for natural phenomena and site hazards. The staff disagreed that these discussions represent beyond design basis scenarios. Regarding the example cited, the intent of this statement was to ensure that long-term possible environmental changes are considered in the design of the UHS. Staff has revised the sentence to read: "For natural sources, historical experience indicates that river blockage (e.g., ice dams or flood debris) or diversion may be possible, as well as potential changes in ocean, river, or lake levels as a result of severe natural events, or possible changes in climatological conditions in the site region resulting from human or natural causes." The staff also added the following in Regulatory position C.1.e: "Current literature on possible changes in the climatological conditions in the site region should also be reviewed to be confident that the methods used to predict weather extremes are reasonable."

Public Comments & NRC Response

Public Comment	NRC Response
The guidance for scoping of SSC's in the Maintenance Rule is in NUMARC 93-01 Rev. 4a, and endorsed by R.G. 1.160. Further, in many cases, the water controlling structures are not in the jurisdiction of the licensee, but other entities. Reference to the Maintenance Rule should be removed, as it is an arbitrary inclusion as written.	The staff partially agreed with this comment that not all water control structures affecting a plant site would be within the jurisdiction of the licensee/applicant. The discussion of the Maintenance Rule has been revised to clarify that only those structures within the jurisdiction of the licensee should be monitored in accordance with the Maintenance Rule and RG 1.160. However, it would be prudent for the licensee to ensure other water controlling structures affecting the safety of the site are being monitored under another program such as the US Army Corps of Engineers National Dam Inspection Program.

Public Comments & NRC Response

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Public Comment	NRC Response
Missing from this is any consideration of how sea level rise may impact the reliability of the UHS during the license period. Pond banks that were initially safe may be washed away by enhanced storm surge for example leaving no cooling water supply. Cooling water that was initially fresh may become brackish and damage equipment not designed for the changed water chemistry leading to failure of critical cooling systems. Changed tidal flow patterns may lead to accumulation of clogging debris where the original design prevented this. If the effects of subsidence on ground water are to be considered, then surely the effects of sea level rise up to at least 2 meters by 2080 must be considered as well.	The staff agreed in part with this comment. The staff agreed that these are important considerations for the design of the UHS systems. In fact, the potential change in sea level was included in the discussion section of proposed Revision 3 to RG 1.27, which states: "For natural sources, historical experience indicates that river blockage (e.g., ice dams or flood debris) or diversion may be possible, as well as changes in ocean or lake levels as a result of severe natural events". The staff has added a new regulatory position under section C.2.a to further address this comment: "(5) potential changes in ocean, river, or lake levels as a result of severe natural events, or possible changes in climatological conditions in the site region resulting from human or natural causes, that may reasonably be expected to occur during the plant lifetime."

Public Comments & NRC Response

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Public Comment	NRC Response
Concern: Revision 2 of the RG 1.27, required transient analysis to include the worst 24-hours following the initial critical time period. This analysis period should remain part of the design basis analysis because peak heat loads from a realistic or conservative analysis may occur several hours after the start of the initial accident. Suggested Revision: Following the site specific UHS critical time period the worst 24-hour period should be maintained as a requirement for transient analysis for peak cooling water temperature.	The proposed revision did not relax considerations for the transient analysis. Instead, the proposed revision specified that the meteorological conditions resulting in the maximum intake water temperature to the plant should be the worst combination of controlling parameters for the critical time period(s) unique to the specific design of the UHS. Depending on the UHS design, the critical time period (i.e., the time interval after a DBA to when the intake water to the plant from the UHS reaches its maximum value) varies. In practice, the 24-hour, post-accident time period has, in many cases, been looked upon as a default time period. Now rather, the proposed revision clarifies that the responsibility for defining and justifying the time period(s) critical to the UHS design lies with the applicant or licensee.

Public Comments & NRC Response

Public Comment	NRC Response
Concern: The existing guidance allows flexible to defer cooling of the spent fuel pools to gain transient analysis margin. Requirements discussing cooling of spent fuel pools should be clarified. Also, the existing guidance allows for significant delays in cooling the non-accident unit to gain transient analysis margin. Emergency procedures direct operates to cool the units to ensure safety margin. Limiting the cooling capability for the UHS structure is inappropriate for a shared safety system (e.g. a cooling pond). Reducing UHS cooling capacity in this manner restricts operational flexibility and reduces plant safety margin. Suggested Resolution: The guidance should prescriptively discuss cooling requirements and the treatment of the associated heat loads in transient analysis to ensure that safety margin is adequately maintained.	The staff partially agreed with the comment. An additional safety function was added to the Background information to further clarifies spent fuel pool cooling: "The UHS performs three principle safety functions: (1)……. and (3) dissipation of maximum expected decay heat from the spent fuel pool to ensure the pool temperature remains within the design bounds for the structure," This addition concurs with the SRP 9.1.3, "Spent Fuel Pool Cooling and Cleanup System." No specified time was included for cooling the non accident unit because neither GDC 5 nor BTP 5-4 specify a cooldown time. GDC 5 specifies an orderly shutdown and cooldown of the accident unit and BTP 5-4, "Design Requirements of the Residual Heat Removal System," Section B 1.D, specifies the RHR system must be capable of bringing the reactor to a cold shutdown condition, with only offsite or onsite power available, within a reasonable period of time following shutdown, assuming the most limiting single failure.