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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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POWER UPRATES SUBCOMMITTEE

OPEN SESSION

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MONDAY

JUNE 22, 2015

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ROCKVILLE, MARYLAND

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The Subcommittee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B1, 11545 Rockville Pike, at 8:30 a.m., Joy Rempe, Subcommittee Chairman, presiding.

COMMITTEE MEMBERS:

JOY REMPE, Chairman

RONALD G. BALLINGER, Member

MICHAEL L. CORRADINI, Member

DANA A. POWERS, Member

STEPHEN P. SCHULTZ, Member

GORDON R. SKILLMAN, Member

ACRS CONSULTANT:

KORD SMITH

DESIGNATED FEDERAL OFFICIAL:

ZENA ABDULLAHI

ALSO PRESENT:

DAN CIFONELLI, Exelon

BOB CLOSE, Exelon

DALE GOODNEY, Exelon

GEORGE INCH, Exelon

MOHAMED KHAN, Exelon

JOSE MARCH-LEUBA, Oak Ridge National Laboratory

DIEGO SAENZ, NRR

TRAVIS TATE, NRR

GEORGE THOMAS, NRR

BHALCHANDRA VAIDYA, NRR

JUSWALD VEDOVI, GE Hitachi

A-G-E-N-D-A

P R O C E E D I N G S

9:32 a.m.

CHAIR REMPE: This meeting will now come to order. This is a meeting of the Power Uprates Subcommittee of the Advisory Committee on Reactor Safeguards.

I am Joy Rempe and I am chair of the subcommittee. ACRS members in attendance include Stephen Schultz, Dick Skillman, Dana Powers, Ron Ballinger and Michael Corradini, and we also have our consultant, Professor Kord Smith.

Zena Abdullahi is the designated federal official for this meeting. In today's meeting the subcommittee will review the Nine Mile Point Unit 2 license amendment request to allow power operation in the expanded Maximum Extended Load Life Limit Analysis Plus, or MELLLA+ domain.

We'll hear presentations from the NRC staff and representatives from the licensee, Exelon. Part of the presentations by the licensee and the NRC staff will be closed in order to discuss information that's proprietary to the licensed unit's contractors pursuant to 5 USC 552b(c)4.

Attendance at these portions of the meeting that deals with such information be limited to

the NRC staff, Exelon and those individuals and organizations who have entered into appropriate confidentiality agreements with them.

At the end of the open part of this meeting we'll have -- we have scheduled a public comment period and prior to the start of the closed portion of this meeting we request that Exelon's staff and their consultants survey the attendees in the room to ensure that all participants are cleared for access to their proprietary information.

A transcript of the meeting is being kept and will be made available, as stated in the Federal Register notice.

Therefore, we request that participants in this meeting use the microphones located throughout the meeting room when addressing the subcommittee.

The participants should first identify themselves and speak with sufficient clarity and volume so that they may be readily heard.

We will now proceed with the meeting and I'll call upon Travis Tate of NNR management to begin. Travis?

MR. TATE: Good morning. I am Travis Tate, currently acting deputy director in the Division of Operator Reactor Licensing in NRR.

The staff is pleased to have this opportunity to provide you an overview of the Maximum Extended Load Line Limit Analysis Plus, or MELLLA+, license amendment application for the Nine Mile Point Nuclear Station Unit 2.

The staff will also describe its review of the Nine Mile Point Unit 2 transient and accident analysis for MELLLA+.

This LAR is the NRC staff's third review involving the implementation of the MELLLA+ with Monticello and Grand Gulf being the other two.

In all three cases, the licensees used NRC-approved GEH MELLLA+ licensing topical report. As the staff concluded for Monticello and Grand Gulf, the NRC staff has determined that operation of the MELLLA+ -- domain in the MELLLA+ domain at Nine Mile Plant 2 provides additional operational flexibility while not compromising plant safety.

The NRC's technical staff's presentation today will include a comparison of the significant differences between the prior MELLLA+ license amendment reviews and the Nine Mile Point Unit 2 review.

In addition, I would like to note that we currently have one additional MELLLA+ application in

house and that is for the Peach Bottom site.

The Peach Bottom application is currently under review and will be scheduled in the near term for the ACRS subcommittee and full committee reviews.

I would also like to highlight -- I know there's been some questions on a few open items that we still have in the staff SE. We plan to address that if it's okay with the committee during the session this afternoon during -- on open items.

CHAIR REMPE: Actually, Travis, if you don't mind because of the open items I would like to discuss them now a little bit --

MR. TATE: Okay.

CHAIR REMPE: -- to understand the schedule and there's a couple of items that I have that I wanted to bring up that are more process related.

MR. TATE: Okay.

CHAIR REMPE: Is this is a good time? Are you finished --

MR. TATE: Yeah.

CHAIR REMPE: -- with your opening remarks?

MR. TATE: Yeah, I'm pretty much finished.

CHAIR REMPE: Okay. So as you noted, in

the draft SE that the staff provided there are several places where it refers that you need to get feedback back from certain other branches -- the staff?

MR. TATE: Yes.

CHAIR REMPE: What is going on? What's the status? Have you received that input?

Because the concern is that we cannot go to a full committee briefing in July if those -- if the ACRS does not have a draft SE that doesn't -- that does indicate that the staff has fully completed its review.

MR. TATE: Yes. In my understanding of that, and Bhalchandra can correct me --

MR. BHALCHANDRA: Okay. Since I was involved in assembling the SE -- sorry.

MEMBER CORRADINI: You need a green. It needs to turn green.

MR. BHALCHANDRA: Yeah, it is there now, right? Okay. I thought it was. I had identified about five items in the draft SE and I already have a staff resolution on one item that deals with providing the safety evaluation.

And if everybody remembers it is related that to REI-14 in Appendix A and we have received it so it's a question of assimilating it into the total

draft.

So I'm pretty confident that I'll be able to incorporate it in the SE within the time frame -- in a short time frame.

The other items are, like you had mentioned, basically confirmation from technical branches that what is in the text is correct and therefore I do not expect any major change in the text that appears right now in the -- in the draft SE.

The only thing I will do after confirmation is remove the notation that says hold for confirmation.

CHAIR REMPE: Okay. We've gotten the May 26th version and even the June 1st and this June 2nd version and that's lines are still there.

My concern is we cannot -- and actually I discussed this with the chairman of the ACRS -- we cannot have this full committee discussion if we don't have an official version that's transmitted to ACRS before the full committee meeting.

And, you know, there's the issue about putting it on the Federal Register. The licensee has made plans to show up in July.

If we don't have it in July it will go to September even -- and we're not even sure we can get

it in to the full committee meeting in September, which will probably start making the licensee very unhappy.

So I need to know when will we get a copy that's official to the ACRS so that we can make this decision about whether to plan for the meeting or not.

MR. TATE: Yeah. I think our goal is to try to get that finished this week and have that wrapped up with the safety evaluation completed this week. I don't --

MR. BHALCHANDRA: That's what I was going to mention that I'm pretty confident that because I have a big item related to REI 14 evaluation already from staff it will not be too much -- it will not take too much time to incorporate it in the SE and close the other items also which are basically confirmation of what is there in the SE already.

So I feel pretty confident that before the end of the week I should be able to send you the -- resend you the SE by removing the items.

CHAIR REMPE: Pretty confident, and by the end of the week is a little too vague. Could we have something that's very succinct? During the day to day, can I ask you, Travis --

MR. TATE: Absolutely.

CHAIR REMPE: -- to make contact or --

MR. BHALCHANDRA: With the branches.

CHAIR REMPE: Yes, with the other branches. Ask them when they're going to have it and then give me -- I don't know if it takes a day to turn around another version but I --

MR. TATE: Right.

CHAIR REMPE: -- need some details that everyone has confidence in that it will be done.

MR. TATE: Right. Yeah.

CHAIR REMPE: So it's time to bring this up and make sure we get that.

MR. TATE: I will make sure I go back and make sure that we have everything lined up to give you a firm date this week when we'll have the SE back to you completed. Absolutely.

CHAIR REMPE: Okay, because the chairman will not let this go on much longer here.

MR. TATE: Right.

CHAIR REMPE: So we need to have that figured out, okay.

MEMBER CORRADING: I had a question that was more about process but a bit more technical in the sense that you identified that Peach Bottom is the next one and there's no other -- there's no other

potential ones sitting in front of the staff at this point?

MR. TATE: Not that I'm aware of.

MR. BHALCHANDRA: I'm not aware of any other one.

CHAIR REMPE: What about Browns Ferry?

MR. BHALCHANDRA: I don't think their application has come in yet.

MEMBER CORRADINI: And so if I might broaden my question, and so given that there's three and you're expecting four, my question is has the staff looked at this in terms of technical issues that have arisen because of the discussion here or within staff that from a lessons learned standpoint there are certain things that are becoming generic that you should look at more deeply with any potential upcoming applications?

Or is everyone so different because of equipment and set points and operator actions that there really can be nothing but a case by case evaluation?

I'm kind of curious about that because we've gone through two. This is the third which, in theory, I understand. But they all seem to -- there are a few things that are -- in my mind that are

popping out.

I'm kind of curious what the staff sees relative to generic things that they should look at if these continue.

MR. TATE: Someone from the technical staff -- could you answer that question?

MR. THOMAS: Yeah, this is George Thomas from Reactor Systems. I'm here for Chris Jackson. Basically, we wanted to look at least two or three of them.

Now we are seeing most of them --- BWR 4, BWR 5 Mark 2 manual stable delivery control system, automatic stability control system so now we come to a point, you know, I think there is not much --- you know it seems spending too much time on this because we already see now three, four of them.

Monticello we are seeing, there on Gulf, now Nine Mile, each one. So, you know, we don't see much using -- going through this line again and again.

MEMBER CORRADINI: Well, the reason I asked my question the way I did is I might agree that if we'd gone into these three or four times and everything looks good that it becomes more -- I won't use the word routine but a little more -- there's more -- we're all -- we're all very familiar with it.

But I'm curious if there is generic things that are popping up that staff needs to look into more deeply. And so is the answer to that no or maybe or come back -- you'll come back and tell us?

MR. THOMAS: We can come back and tell you but my personal opinion is that there is no using -

MEMBER CORRADINI: Okay.

MR. THOMAS: -- this again and again. Okay. You can go back to my recommend and then hear from --

MEMBER CORRADINI: Okay. But I -- but I do think as an action item for the subcommittee I think this would be useful because at least from my standpoint there are a couple things that seem to be coming up at least twice, maybe three times, that we at least should clear up so that if this continues with other applications we're well ahead of it and we're not dragging in the applicant or the licensee, I should say, or the staff asking the same set of questions again and again.

CHAIR REMPE: And I think those couple of items that come to mind will be emphasized again today and they've come up in the last couple. I think what he's getting to is obvious.

MR. BHALCHANDRA: Yeah, I was just going

to mention when we were trying -- we were assembling the SE for Nine Mile Point 2 we made a concerted effort to incorporate what was happening during the subcommittee hearings for Grand Gulf and tried to improve on the SE to hopefully to have all the same questions coming from subcommittee for Nine Mile. I hope it has worked. You will tell us pretty soon.

CHAIR REMPE: There's another question I'd like to bring up that's a bit different with this one that I didn't see with Grand Gulf and Monticello and that's related to this recommended areas for inspections in Section 4.4 of your draft SE.

In particular, I'm a little bit perplexed about the phrase full implementation in MELLLA+ with only partial testing will not be acceptable and that implementation of the MELLLA+ will be limited only to the region where testing has performed or has been performed.

What exactly -- I mean, we can wait and talk about this more in the closed session but this is something that was a little perplexing because there is a certain region that's associated with this application and are you planning to not -- the testing to not grant them the full access to that in the region?

MR. BHALCHANDRA: Actually, some of the technical staff is ready to cover that point. But if you want to cover it right now then --

CHAIR REMPE: We can wait. But I just wanted to give you heads up because that was a little bit different and I didn't see that before.

MR. BHALCHANDRA: Yes. We are aware of that and -- we are aware of that and they're going to cover it in their presentation.

CHAIR REMPE: Okay. So with that, I'll turn -- let you do whatever you want to do next here.

MR. TATE: Okay. No, I was done and at this point I just want to thank you for your time today and like to turn the meeting over to Bhalchandra Vaidya, who's the project manager for Nine Mile Point 2.

MR. BHALCHANDRA: Thank you. I'm trying to learn how to go to the next slide.

Hello, I am Bhalchandra Vaidya. I am the licensing project manager for Nine Mile Point 2 MELLLA+ amendment.

I have provided a CD containing draft SE and all the licensee submission to ACRS. I'm sure you have looked at all that material.

I just want to go briefly go over the

review time line and basic aspects of this amendment. Licensee submitted the application for license amendment on November 1, 2013 and we went through acceptance review and after licensee submitted some supplemental information on January 21 we accepted the application.

And in the original application of November 1, licensee had committed to provide some other information which was submitted on February 25.

Licensee submitted the revised application on June 13th, 2014 to reflect the completion of -- complete implementation of changes related to standby liquid control system.

Licensee implemented the amendment regarding improvements to standby liquid control system during the spring 2014 outage and that is the reason -- basically the reason for revising the application because a number of things they had identified in November 1 were longer needed and that's how they -- that's why they revised it.

There was no change to the basic content of the application. After that I think we -- I'm sure we published the biweekly -- Federal Register notice regarding no significant hazard determination on June 6th and August 5.

June 6th was based on November 1 application and August 5 was revised based on revised application. Staff during the review issued multiple rounds of requests for additional information -- RAIs -- on various topics such as reactor systems, instrumentation controls, human factors, et cetera and licensee provided their responses to REIs during the period of March 7, 2014 to February 18th, 2015.

Staff also conducted an audit at Nine Mile Point 2 site on November 20, 2014. Licensee's existing license condition and proposed numerous technical specification changes support MELLLA+ application.

There are -- Existing License Condition 7 restricts free water heater out of service by imposing a 20 degrees Fahrenheit free water temperature ban and out of numerous technical specification changes I will just mention a few of them.

The proposed fee has changed for TS LCO, which is limiting condition of operation 3.4.1, prohibits single loop operation in MELLLA+ expanded domain.

Some other changes are revised safety limit in TS 2.1.1.2 by increasing the SLM CPR value for two recirculation loops in operation from greater

than 1.07 to greater than 1.09.

Another one is revise the acceptance criteria in TS 1.7.7, which is standby liquid control system surveillance requirement by increasing the discharge pressure value from greater than 1,327 pounds PSIG to greater than 1,335 PSIG.

There are a number of others but they are just too numerous to list here. That is why I have avoided that.

MEMBER SKILLMAN: Let me ask -- let me ask this question.

MR. BHALCHANDRA: Yeah.

MEMBER SKILLMAN: Let me ask this question, please. That is an 8 PSI out of 1,300. Why is that sufficient?

MR. BHALCHANDRA: I would probably request technical staff to see whether they can answer and provide a response to that.

MR. THOMAS: I didn't get a date for people from this for instrumentation and control --

MR. BHALCHANDRA: Oh, okay.

MEMBER CORRADINI: But we'll eventually get the answer, right?

MR. BHALCHANDRA: Yes. Make sure that during this -- no, and during their presentation they

will provide the response.

CHAIR REMPE: Also, if I recall correctly the text that was related to the single loop operation it actually had some funny words about intentional operation and it prohibits intentional operation in single loop operation.

It has some fuzzy words in there and why were those fuzzy words added? I mean, is it prohibited or not? What is the -- are they going to say oops, I didn't meant to, sorry?

MR. THOMAS: I think it's prohibited.

CHAIR REMPE: It is prohibited but the actual words that are in the draft SE and I believe actually in the report it has something about intentional operation.

MR. THOMAS: Okay. But we can maybe change it.

MR. MARCH-LEUBA: This is Jose March-Leuba, Oak Ridge National Laboratory. This is a tech spec kind of language. If they lose the pump they will have to scram the wheel, they have to exit that condition within immediately between 12 hour. So if open the plant on a single pump they will be operating in a single rule.

CHAIR REMPE: Okay.

MR. MARCH-LEUBA: But it will not be intentional.

CHAIR REMPE: Okay. Thank you.

MR. BHALCHANDRA: Well, I think my summary of the review part is complete and if you don't have any other questions for me I will turn it over to the licensee for their part of the presentation.

MR. KHAN: All right, good morning. My name is Mohamed Khan. I am the engineering manager at Nine Mile Point Nuclear Station.

I would like to thank the ACRS Subcommittee for this opportunity and the time to brief you on Exelon Nine Mile Point Nuclear Station Unit 2, operating license amendment request to allow the plant operation in a Maximum Extended Load Line Limit Analysis Plus the main level, plus on the previously approved extended power upgrade conditions.

This expanded region provides greater operational flexibility that would significantly reduce the need for frequent downpowers and for control rod panel adjustments, as well as a number of deep downpowers.

My technical team and operations staff from Nine Mile Point and representatives from Exelon Corporate Fuels and Regulatory Assurance, along with

representatives from General Electric-Hitachi are here today to review with the subcommittee an overview of the project scope, modifications that have been previously implemented, testing of implementation activities that remain, and provide an overview of the procedure changes and the remaining training to support the implementation.

Here with me presenting is Dale Goodney to my left, Senior Project Manager, followed by George Inch, my Technical Senior Staff Engineer, and Dan Cifonelli, Licensed Unit II Operations Shift Manager.

All the licensee participants here today from Exelon Corporation includes Nuclear Fuels, and also Regulatory Assurance, and to the back, representatives from GE-H, General Electric-Hitachi.

Also on the conference line are technical support from the staff, from Nine Mile Point's technical team and also from GEH.

On the agenda today, I will be providing a station overview, followed by Dale Goodney, who is going to provide the project overview, followed by George Inch, who is going to discuss the design analysis section, and lastly, followed by Dan Cifonelli, who will provide an overview of the procedures and the training that remains.

A brief overview of the station, Nine Mile Point Unit 2 is a General Electric BWR-5 and a Mark II Containment. It began commercial operation in 1988 and is licensed until 2046. It is on a 24-month operating cycle with the core consisting of all GE 14 fuel type.

We have three electric motor-driven feedwater pumps. Each pump is rated for 65 percent capacity. So, rated conditions to feed system is designed to operate with only two pumps in service.

We also have two reactor recirculation flow control valves loops. They are both constant speed pumps with flow regulated through the flow control valves.

The unit was licensed for initial core flow during plant startup between 100 to 105 percent core flow, which is our current operating region.

And last, designed feature is the Redundant Reactivity Control System, which includes two important automatic features important for ATWS, and that includes the Automatic Standby Liquid Control System and the automatic feedwater runback feature.

CHAIR REMPE: Excuse me.

MEMBER CORRADINI: Can I ask a question about that, if I might, since you brought up RRCS?

So, in our limited time, sometimes that is there for automatic feedwater runback and sometimes it is not. Can somebody explain from a design standpoint why it is an optional thing or is it just evolutionary?

MR. INCH: I think I can start. I think there are four BWRs and GE can help me out here, that have a Redundant Reactivity Control System that includes an Automatic Standby Liquid Control System pump start and also feedwater runback.

There is a lot of plants that have Redundant Reactivity Control Systems that have open rod injection and recirc pump trip features. But the one at Nine Mile and I think there are three other plants, have additional features.

MEMBER CORRADINI: And from a design standpoint, is that something that is optional and somebody took the option or is it something about how the machine is designed that this fits into how it should operate?

MR. INCH: I think in that generation of design of the redundant reactivity control system that Nine Mile II was built to, I believe that was the offering from GE that plant selected to. But depending on what vintage the plant was, what era the

licensing was, it was different.

GE, Craig or Bruce, could you elaborate?

DR. VEDOVI: This is Dr. Juswald Vedovi from GE-H. It was evolutionary. So, some plants happened to have the possibility to include these evolution in the design and some others did not.

MEMBER CORRADINI: Okay. And then since you are up, how complex is this option?

DR. VEDOVI: I'm sorry?

MEMBER CORRADINI: How complex is it in terms of is it a matter of control system logic or is it a matter of a whole different feedwater pumps? I'm trying to understand if I get into the details, is it --

MR. INCH: I can't speak in generic but we have electric feed pumps. So, for our design, the design has -- they have the digital logic coming out of the redundant reactivity control system, which then has an additional analogue system logic that controls the feedwater red valves and the bypass valves, in order to achieve that. And then for standby liquid control, it interfaces with that system.

So, it is not a simple design but it has complexity to it.

MEMBER CORRADINI: Okay, so I have two

more questions and then you can hold me off since you are just in the interaction phase. But so the next question in my mind is okay, so it is digitally monitored and then analog actuated. So, I am curious about what that doesn't work and then the operators have to do something manually.

And the second part of it is, if this is such a good thing, why wasn't it retrofitted into other designs? Or because it is an electric-driven pump with a certain vintage or type versus a steam-driven, it can't be retrofitted. These sorts of details intrigue me, since this is our third shot at this and each one has been different.

MR. INCH: With regard to the 10 CFR 5062 for the ATWS rule, it was not a requirement.

MEMBER CORRADINI: Okay.

MR. INCH: It was a feature that --

MEMBER CORRADINI: Was available.

MR. INCH: -- Niagara Mohawk elected to have is the best I understand. We can have that fact-checked.

MEMBER CORRADINI: Okay.

MR. INCH: But I believe that is how it came about.

MEMBER CORRADINI: And then -- well, okay.

But then we can defer that. But I am also curious about, from a technical standpoint, if it fails and I don't get a digital control that says run back, how are the operators trained to observe that and react within some time window?

MR. INCH: I think Dan is in the position --

MEMBER CORRADINI: If we are going to get to that later, that's fine.

MR. INCH: We are going to get to that.

MEMBER CORRADINI: Okay, thank you.

CHAIR REMPE: Before you leave this slide, I have a simple question. What is the power density for this plant?

MR. INCH: At rated EPU power, which is 3988, the power density is 58.99 kilowatts per liter.

CHAIR REMPE: Okay, thank you.

MEMBER CORRADINI: We are having an argument amongst us as to whether it is power or power overflow. So, that is just a continuing argument. So, you are not involved.

MR. INCH: We've got the numbers both ways.

CHAIR REMPE: And we will report it as such. Anyway, go ahead, please.

MR. KHAN: Okay. So, a brief overview of Nine Mile Point Unit 2 history. We received our Full Power Operating License in 1987 for 3,323 megawatts thermal. We went to stretch power uprate in 1995, which took us to 104.3 percent OLTP and we implemented the Option III stability solution in the year 2000 and renewed our operating license in 2006 but will enter the renewed period starting in 2026.

We implemented the MELLLA operating domain, which allowed for core flow down to 80 percent in 2008 and lastly, we implemented the extended power uprate in July of 2012. Unit 2 is currently in its second operating cycle under EPU conditions.

At this time, if there are no further questions, I would like to turn it over to Dale Goodney.

MR. GOODNEY: Thank you, Mohamed and good morning. I'm Dale Goodney. I'm the Project Manager for the MELLLA+ project at Nine Mile Point.

This is a general project overview and I'm going to be covering MELLLA+ licensing, MELLLA+ benefits, the project scope, and I will be discussing our implementation plan.

The Nine Mile 2 MELLLA+ license amendment scope included the expanded operating domain and the

DSS-CD stability solution, along with the associated tech spec changes.

The MELLLA+ safety limit minimum critical power ratio tech spec change was also submitted with the initial MELLLA+ license amendment request, as was mentioned earlier.

There are no other pending license changes related to MELLLA+, either under review or to be submitted. There was, however, one other previous license amendment that was related to MELLLA+. That was for the enriched boron. That was issued to Nine Mile 2 in March of 2014 and it was implemented in April 2014 during the reviewing outage.

CHAIR REMPE: Dale, you can answer this later but with the DSS-CD, there are some questions I have about the phrase power suppression trip signal and how it actually works. Does it give an alarm when it starts, when certain parameters are reached and that alarm is used by the operators to try and intervene before actually a trip signal is initiated? Is that the way this works?

Because that phrase, I was discussing it with another colleague that is a member on ACRS with respect to another plant. And they were curious about what that phrase meant because you said you thought

that would confuse operators, the phrase power suppression trip signal.

MR. GOODNEY: Well, there are two levels. There is an alarm that comes in, based on a number of confirmation counts, along with the amplitude. That is set slightly lower than the actual trip signal.

How that works in terms of the actual thermal hydraulic parameters, you could maybe provide a little bit more, elaborate on that some more, Juswald.

DR. VEDOVI: Yes, this is Dr. Juswald Vedovi from GE-H. Specifically, are you interested in how the alarms is triggered?

MEMBER CORRADINI: I think she is asking what confuses me, which is is that just to tell the operator, uh-oh, something is about to happen, or is there an action that is to be initiated?

CHAIR REMPE: Well, not only does it give the operators uh-oh, something is about to happen, they actually have that chance to intervene before the trip is initiated is my understanding.

And again, this is a colleague who is not here today. We were discussing and he said well, he thought it was just a trip and so we wondered.

DR. VEDOVI: Yes, the main function of the

alarms, which is not a licensing basis for neither Option III or the DSS-CD is to provide operator, yes, with the opportunity to take an action in the case of maneuvering or there is low flow reduction events that results in a slow growing power escalations. So, those are the scenarios where the alarms are going to be useful and so that the operator has a chance to reduce power and prevent to have any stability to occur.

In the case of a two recirculation pump trip, for instance, it results in high grow rate, there is not going to be much difference in timing between the alarms and the trip itself. But the trip, itself, is set at the setpoint, such as the safety unit minimum critical power ratio, in that case is protected, regardless of the timing.

CHAIR REMPE: Thank you.

MR. CIFONELLI: So, from an operator's perspective, it is treated similar to other parameters that would approach an RPS setpoint.

Now the setpointality is reactor water level that was lowering toward a scram, the operators would get an alarm and the alarm response training experience in procedures would require the operators to take action to stop the adverse trend.

Similarly, with the OPRM RPS trip signal, the alarm response provides guidance to the operator on how to respond.

MEMBER CORRADINI: Before you reach this one.

MR. CIFONELLI: Well, like Juswald said, it is not quite as simple as reactor water level because I can't see the oscillations going on in the core. So, it has more to do with how we got there that is a trip of a recirc pump, the alarm response procedure has some certain additional control rods until the alarm clears and to exit the exit region. And that is expected to prevent a trip.

CHAIR REMPE: Okay, thank you.

MEMBER SKILLMAN: Let me ask this question. A minute or two ago, one of the gentlemen mentioned that you were in your second cycle of your EPU. And in the EPU, you increased your power level from 3467 to 3988. So, you have been at 3988 now for 18 months or 24 months or 30 months.

MR. KHAN: Since July of 2012.

MEMBER SKILLMAN: What have you learned in plant behavior in your higher power level versus your prior power level?

MR. INCH: Actually on some of my slides

in the design analysis presentation, I will be talking about things, our experience as it relates to MELLLA +.

MEMBER SKILLMAN: Well, give us one minute so, by the time we get there, we will have had a chance to think about it.

MR. INCH: Okay. We have got experience with moisture carryover, for example. That is one of the things that is impacted. We also have our operating experience with core flow and what our margins are. We have operating experience with regard to hydrogen water chemistry and how it interacts at EPU power levels. So, a few items.

MEMBER SKILLMAN: Thank you. I will wait for the next one. Thank you.

MR. GOODNEY: Okay. This is a licensing time line that shows the key milestones, most of which Bhalchandra already covered.

As he mentioned, there were RAIs were actually five rounds of RAIs. All responses have been submitted and, at this point, there are no open questions that we are currently working on.

Looking forward, we understand that the full committee is tentatively scheduled for July 2015, next month. Based on that, we are anticipating

receiving the MELLLA+ license amendment as early as August and we have built our implementation plans for the license amendment around receiving that amendment in August.

The benefits for MELLLA+ for Nine Mile 2 is similar to the two other plants that have already been reviewed. It does significantly expand the core flow operating margin at 100 percent power. That increased operational flexibility allows us to maintain the greater margins of the MELLLA+ rod line at the lower core flows and also reduce the number of control rod manipulations, as well as the number of plant downpowers required for rod pattern adjustments.

The power to flow map shows the comparison between the pre-EPU core flow window and where we are operating today. Today, our allowable core flow window is between 99 percent and 105 percent core flow. The actual in practice is somewhat less than that that I will show in the next slide.

With MELLLA+, the core flow window would be 20 percent, which, essentially, gets us back to where we were pre-EPU.

CHAIR REMPE: Before you leave that slide, I'm curious about the process. As I'm sure you are aware, you could have down to 80 percent with MELLLA+

and you selected 85 percent. Could you discuss why, what analysis were done, et cetera?

MR. INCH: The original scoping evaluation was done for MELLLA+ in 2007 time frame as part of EPU by GE. And the plant considered what window was appropriate for Nine Mile and that is when the 85 was selected. Because I think Dan will show you the full power flow map and how we operate and where the transition to high speed on the recirc pumps and the rod lines. So, we really didn't need to go to a higher power -- a higher rod line, if you will, due to the way it was set up.

So, it was an early decision in the scoping.

MEMBER CORRADINI: So, we'll discuss that in closed session.

MR. INCH: We can.

MEMBER CORRADINI: Because I had the same curiosity.

MR. GOODNEY: Okay, moving on, the next slide shows the reactor power history. This is actual data over the last four months of the first EPU operating cycle, that would be towards the end of 2013, early 2014. And it shows the downpowers for the rod pattern adjustments.

This data was provided by our reactor engineering group and they are projecting that with the larger core flow window, that we would be able to eliminate all of the smaller downpowers. Those are down around the 98 percent range.

And for the larger downpowers, which are in the 65 to 80 percent thermal power, we would be able to reduce those by about one-half. So, significantly less rod manipulations by operations.

MEMBER CORRADINI: This isn't relevant to this, but since you showed the slide, what is the limiting rate of downpower? In other words, when you go down, you cannot go down faster than what percent per minute or any statistic? Or, if we are not allowed to speak about it here, we can wait.

MR. CIFONELLI: I don't have the exact number for the rate.

MEMBER CORRADINI: But is it like approximately a percent per minute or is it much faster than that?

MR. CIFONELLI: Normal manipulation of the system is slow. The two recirc groups each have split just to have a fast speed and a slow speed. And our operators use the slow speed, all normal manipulations.

If we are in a --

MEMBER CORRADINI: Because it loss instantaneous here but I am sure it is not.

MR. CIFONELLI: -- normal situation, we can move it fast. And these are depicting a plan for activity maneuver for control rod sequence exchange.

MEMBER CORRADINI: Including the large downpowers or just the little blips?

MR. CIFONELLI: Both of them. So, this is a large time frame. So, if we were to expand the x axis out, it would how that the recirc flow has actually come down very slowly.

MEMBER CORRADINI: Okay, fine.

MR. INCH: The real limitations are on not the down but going up. And they are related to fuel preconditioning provisions.

MEMBER CORRADINI: It is a curiosity. We can wait until we are in closed session, if that is where it is appropriate.

MR. GOODNEY: Okay, the next slide is actually it is for the same time period as the previous slide but this shows the core flow. And really what it is intended to show is how narrow the core flow window that we currently have really is. You see is about 100 to 104 percent and that upper

bound is really depending on where we are in the operating cycle and other conditions that George will talk in a little bit more detail later on what those limitations are.

The lower bound, at 100 percent, allows us to maintain one percent margins to the rod line. We really like to maintain around a two percent margin. So, MELLLA+ will be able to operate all the way down to 87 percent. It gives us a two percent margin for the 85 percent core flow we talked about earlier.

So, again, greater operational flexibility to be able to maintain our margins.

What MELLLA+ does not affect -- most of the major plant operating parameters, such as reactor pressure, core thermal power, licensed core flow, feedwater flow and temperature does not require any modifications to the balance of plant equipment. Again, it is very consistent with the other plants as well.

For Unit 2, the scope does include the revised power to flow maps and the DSS-CD stability solution, margin improvements in the standby liquid control system that we kind of already touched on, new OPRM settings to maintain margin to the MELLLA+ rod line, and the MELLLA+ reload analysis.

We will be covering each one of these in more detail in the next two presentations with George and Dan, unless there are any further questions.

MEMBER SKILLMAN: Dale, let me ask you this. You are the Project Manager for this. In a 24-month fuel cycle, my experience is you plan the cycle in advance. You load 680, 690 effective full power days. You allow 30 days for an outage or 28 days or whatever your corporate goal is. And you allow some variance in there, perhaps, for a downpower for condenser cleaning or something such as that that you load 695 or nearly 700 days effective full power at 235.

One of the great benefits of MELLLA+ is not using that reactivity that is consumed when you are maneuvering. You don't have to do those deep draws and you don't have to utilize that reactivity to bring the plant back up, overcome xenon, that type of thing.

Do you have any idea how many effective full power days you gain in your fuel cycle by going to MELLLA+?

MR. KHAN: I couldn't answer that off the top of my head but our Fuels representative may be able to help on that.

MR. CLOSE: My name is Bob Close. I'm with Exelon Nuclear Fuels, Senior Staff Engineer.

And I am actually going to let you down gently and tell you that the actual, if you would, measurable capacity factor benefit from elimination of the downpowers for the rod withdrawals, and even the minor notching, it really probably only comes out to maybe a couple of effective full power days' difference in capacity factor. Really, the benefit is really seen in the reactivity management that you are not doing.

So, it doesn't really translate itself, if you would, into a fuel economy benefit that is large. It is really about the decrease in reactivity management, where it has the big value. You are just moving control rods less. You are maneuvering the plant through a maneuver from 100 percent down to 65 percent or even just 80 percent. You know it is not insignificant to watch all the equipment and make sure everything moves smoothly. So, that is really where we see the value.

On the economics, it is really just maybe an effective full power day that is scrubbed off.

MEMBER SKILLMAN: Thank you.

MR. GOODNEY: Okay, thanks, Bob.

In terms of the implementation, the installation and tests associated with MELLLA+ implementation are governed by the station design change and work control processes. These process ensure that all of the engineering documentation, procedures, and training, are all completed, in order to support the MELLLA+ implementation.

Once we receive our license amendment, we will implement within 90 days in accordance with our MELLLA+ licensing submittal. We are currently scheduled to complete within those 90 days.

The actual implementation is in two phases. We have both an offline, as well as an online portion for implementation.

If you go to the next slide, it kind of breaks down the work packages. The offline, as indicated here, has already been completed. And that was in May 2014, during the refueling outage. During that outage, we implemented the tech spec amendment for the enriched boron. And we also installed the DSS-CD stability solution.

That equipment has already been installed and fully tested. We are currently operating the DSS-CD trip output bypass to prevent the confirmation density algorithm RPS trips, pending implementation of

the tech spec change.

Once we receive our license amendment, we will be performing the online portion, which is currently scheduled in September 2015. We will enable the DSS-CD by removing the jumpers.

There was a question that was relayed to us, I believe from ACRS last weekend, the processing for arming the DSS-CD as well as how do we ensure that it is operating correctly.

We did add a slide to the presentation. Maybe at this point, we can go to the last slide. And this provides kind of a sequence of how that is going to happen but basically, there are eight physical jumpers installed. There are two per each APRM logic module.

We will be removing the jumpers off from one module at a time, one channel at a time to maintain protection while we are performing the activity.

We also will be installing what is called an RPS test device. This is a device that is installed in the RPS circuitry. It allows us to be able to perform this work, as well as perform the functional testing without actually bringing in a half scram.

MEMBER CORRADINI: Without doing what?

MR. GOODNEY: Without bringing in half of the scram.

MEMBER CORRADINI: Okay.

MR. GOODNEY: So, we can actually see the contact state change in that circuit, without dropping off the main relays.

So, what are the appropriate LCO actions for the first logic module? We will have the RPS test device installed. We will physically remove the two jumpers for that particular channel, after which we will perform the channel functional test and that will check the logic all the way from the APRM all the way out to the RPS circuits.

Once that is complete, we will remove the test device, exit the LCO, and then we will do it for the next channel. So, that is physically how we will be removing the jumpers.

And that basically arms the DSS-CD trip output into the RPS.

Does that answer that question? Okay.

All right. We will also be making the set point changes. There are some minor setting changes for the OPRM for the defense-in-depth algorithms. We will also be changing the power and flow operating

window for the DSS-CD, and the APRM setpoint changes will also be made at that time.

While that is going on, we are going to be implementing the MELLLA+ reload analysis that consists of installing a new 3D monocore data bank and also the MELLLA+ core operating limits report.

Once those two activities are completed, the tech spec will be implemented, basically, and then we will be ready to move in to the actual MELLLA+ testing, which, again, will occur at power.

We have later on in our presentation more detail on what that MELLLA+ testing looks like, power levels, what type of tests we are going to be performing at each power level.

So, I will defer more discussion on that until we get to that part of our presentation.

Okay, so that really concludes my portion of the overview. Again, I think the benefits are clear from a project standpoint. We are, the whole organization, the site, the maintenance, all the departments are currently planning on doing the implementation. It is the second week in September. So, we are prepared for that.

Unless there are any more questions for me, I will turn it over to George for the design and

analysis.

MR. INCH: Good morning. My name is George Inch. I am the Senior Staff Engineering in the Engineering Department at Nine Mile Point Nuclear Station at Exelon.

What I would like to do is provide you a basic overview of the approach that was set up when we started the MELLLA+ project. And when we did that evaluation, there are two key features that we considered important. The first one was we made a decision to use a 92 percent atom percent of boron-10. And that includes margin and eliminates any eliminates any issues with suppression pool temperatures. So, we are going to have a higher rod line, so in an ATWS event, you have more heat added to the suppression pool.

So, by using the enriched boron, we are able to actually improve the margins, as opposed to changing those.

MEMBER SKILLMAN: George?

MR. INCH: Nine Mile 2 is --

MEMBER SKILLMAN: George, let me ask this. Do you have boron at any other atom weight percent on this site?

MR. INCH: Dale?

MR. GOODNEY: Yes, we do. At Nine Mile Point Unit 1, we have got boron that I believe is about 65 percent.

MEMBER SKILLMAN: So, explain to us the rigor and discipline to ensure that the right boron is in the right place because it all appears the same. If you have a handful of one and a handful of the other, you honestly can't tell the difference.

How do you ensure that the correct atom weight percent is where it is supposed to be at this unit?

MR. GOODNEY: Well, one of the ways we handle that is through the inventory control system. Each unit has its own specific item number that we call it. So, Unit 1 has its item number. Unit 2 has its item number. And from there it is controlled, the installation of it is controlled by the procedures and work packages when they have to adjust the concentrations.

We do know that from putting in the 92 percent boron, it is a slightly different consistency than the other boron that was in there. So, they may be able to tell just physically by looking at it but we do have controls in place through the inventory control system to make sure that they are kept

separated and that the physical work packages ensure that they only put in the correct item number for that particular plant.

MR. CIFONELLI: The additions are controlled procedurally and the procedure will reference the inventory control system, the symbol number that is associated with each concentration of boron. The Chemistry Department is the department who does any adjustments or adds to the tank and then proceeds to derive the configuration control. It is part of a configuration. It is part of the process.

MR. GOODNEY: Each bag is also labeled with the specifications for the content, to include the enrichment, as well as our item number would be right on the bag itself.

MEMBER SKILLMAN: If one were to review your corrective action program for the last say 60 months, the last five years, would there be any items that would point to failure to use the correct atom weight percent of boron?

MR. GOODNEY: I would say no but that would be a big deal.

MEMBER SKILLMAN: Yes, it would.

MR. GOODNEY: And I think we all would be aware of that. And the answer is no, there are none.

MEMBER SKILLMAN: Fair enough. Thank you.

MR. CIFONELLI: Another piece of that would be also a technical specification violation and would be reportable.

MR. INCH: The 92 percent boron also would demonstrate it improves the standby liquid control system redundancy. I will talk about that in a little bit more detail.

We have mentioned it before and we will probably be repeating ourselves quite often but our key aspect of how we have analyzed both the ATWS and OPRM analyses and the ATWS with instability is with the redundant reactivity control system features with the automatic standby liquid control and the runback. And what that helped us with is, obviously that we are able to achieve the runback and the SLC injection more rapidly.

So, the requirements for operators are relaxed so that they are not having to react as fast for the events.

MEMBER SKILLMAN: Before you go on, you say not as fast. You have got to initiate SLC injection in 98 seconds. Is that a change or is that what you had prior?

MR. INCH: That is the same.

MEMBER SKILLMAN: The same? Yes, sir. Okay, thanks.

MR. CIFONELLI: That is also an automatic feature.

MR. INCH: This is just an overview of different aspects of going through in the body of the presentation.

What I would like to cover first is what our experience is for the power uprate and what core flow operating margins we have achieved.

When we did power uprate, we did, in order to get to full EPU power, we needed to restore the design performance of the jet pumps. There was fouling involved. And in order to do that, we made the decision to install new mixers that were the same design mixers but they had an anti-fouling coating.

Those mixers were successful in restoring the design performance back to original design. And when we did the power uprate testing, the performance of the jet pumps actually plotted right along the performance line from 1987, the original startup of the jet pump mixers.

Now, for EPU power with the limiting power core resistance, even though we are licensed for 105 percent core flow, we had the GE calculations

indicated our max capabilities are going to be 103.9.

We have achieved approximately 103.9. It is depending on where you are in the operating cycle and what rod pattern it is. It is somewhere between 103 and 103.5.

Under those conditions, we have to operate with the flow control valves full open. So, and when you are at full open, the drive flows are somewhere around 46,000 to 46,500 GPM.

So, at end of cycle conditions, as the core DP changes, we are able to get to the 105 percent window for increased core flow.

So, you are at EPU, the MELLLA line is 99 percent core flow, operations seems to maintain margin to that. So, as a practical matter, you have a very small window. I think Dale showed you the operating data. And that is with this system new clean jet pumps, the coating seems to be working. We haven't seen any fouling but that is a very small margin window.

MEMBER BALLINGER: This is a titanium coating?

MR. INCH: Yes.

Our operating experience for moisture carryover with power uprate is also important because

one of the things that is impacted with MELLLA+ is moisture carryover. As you operate it at lower core flows the steam separator performance changes, as you get higher quality steam.

So, what our experience is with EPU is our moisture carryover improved, compared to pre-EPU conditions. We were operating with moisture carryovers, so 0.05 to 0.07 at CLTP conditions and after EPU we saw moisture carryover in the order of 0.025.

So, and that is important when you go on to our assessment of what the impact of MELLLA+ was because the predictions for the design predictions for moisture carryover were indicating the potential for us to be upwards of 0.23, 0.24 weight percent, under some limiting conditions during the cycle. It wasn't the whole cycle but it was about five percent of the time we might run into that.

MEMBER CORRADINI: And that is at 85 percent flow?

MR. INCH: Eight-five percent flow, yes.

So, now those predictions also were saying for EPU, they were expecting us at those same state points to be on the order of 0.125. We haven't seen that. We have seen, as I said, we haven't seen

moisture carryover to get up above 0.03.

MEMBER CORRADINI: But just so I guess I should know this, but I don't, so this is more investment for maintenance issues relative to the turbine than it is a safety issue.

MR. INCH: Yes, that is correct.

CHAIR REMPE: Remind me, because I have forgotten. Did you put a new dryer in for Nine Mile when you did the EPE?

MR. INCH: No, it is the existing -- the original dryer.

MR. POWERS: Your moisture carryover is limited, primarily, by inertial impaction?

MR. INCH: Excuse me. I didn't hear you clearly.

MR. POWERS: Moisture carryover is limited by inertial impaction and droplets.

MR. INCH: I think the moisture carryover is really, the increase is related to the steam separator performance and how effective it is in removing moisture. And there is an optimum band on the separators in terms of the quality coming off.

As the quality comes up higher, you actually get higher moisture breakthrough from the steam separators. So, the moisture carryover for them

is really for MELLLA+ is really not related to the dryer. It is related to the core exit conditions and the steam separator performance.

MR. POWERS: But the mechanism at which separators and dryers operate is primarily inertial impaction.

MR. INCH: Yes, okay.

MR. POWERS: So, at higher velocity, you should get more inertial impaction.

MR. INCH: I think GE, I'm not sure if one of the folks from General Electric might be able to expand on it. And I think I have a backup slide from GE.

MEMBER CORRADINI: I guess Dr. Powers' question is kind of the same as mine as to why. And so what I am hearing you say politely is it is a black art and you just found this empirically and you don't know why.

MR. INCH: No, GE knows why. There is testing performance in terms of how the separators work.

So, that curve, can you see it? You'll see there the inlet quality and on the right-hand side, carryover and then carry under. That is for the GE design separator. So, depending on what the

quality is, you get actually more carryover coming out of it.

Exactly the details of how that works in the separator design, I would need to ask GE to provide some additional elaboration.

That is, functionally, from an analysis standpoint, as to why they are predicting the carryover to go up because they are predicting higher quality in central locations in the core for the certain operating points in the cycle, at the lower core flow.

So, moving on to the -- so, our analysis for radiological, we have evaluated up to 0.35 weight percent and that was the original radiological evaluations were done for that. And we have analyzed the piping and 0.425 weight percent. We used that because that is the limiting quality for the MSIVs, the outboard MSIVs. So, as long the quality leaving the reactor is 0.25 weight percent or less, then the quality at the MSIV is below the threshold for possible damage to the outboard MSIV.

And there is monitoring in place for the moisture carryover to control and identify if we are approaching the limits. And then there is also the ability of operations and reactor engineering to

adjust our power level to stay below 0.25 weight percent.

The next slide is the long-term stability solution. The DSS-CD is basically designed to improve the stability solution over the Option III and it initiates insertion to terminate the oscillation prior to any significant amplitude growth.

It replaces Option III. Option III stays in the background. There are some setpoint changes or the Option III. So, there are some changes that were made during the process that Dale will explain when it is implemented.

It protects against the safety limit MCPR for stability events. And we didn't take any exceptions to the DSS-CD LTR. I believe the latest LTR, our submittal is Rev. 7. I think the final approved version is Rev. 8 of that LTR.

With regard to the automatic backup stability and the manual backup stability, Dan Cifonelli is going to summarize our power flow maps and he navigates the different regions and how you go from manual to automatic. And so, if you have any questions there, I think Dan will get into that in some detail.

And the tech specs do require if you can

implement the manual, I can't imagine why you wouldn't be able to but if you couldn't implement it, you are required to get below 18 percent power.

Unit 2 Nine Mile has significant experience with the Option III system that was installed in 2000 time frame and it has been installed for 15 years. And we have been operating for approximately one year, a little over one year, with DSS-CD in the background, with the jumpers in. And the alarms would have come in if there was any issue. So, we haven't had any alarms.

With MELLLA+, the supplemental reload licensing submittal was provided to the NRC in February of 2014. Now, we are implementing now for cycle 15. So, with cycle 15, we are also basing it on Rev. 4 of the NEDC 33173 and that changes some of the limitations and conditions that apply.

For the GE 14 core design, our safety limit for two loop operations going to increase from 1.07 to 1.09, when you add the LTR limitation in Condition 9.5. That includes the off-rated uncertainty for single loop operation that is related to core flow uncertainty of 0.03.

Here, I identified what our power densities are, as it relates to the application in

these adders.

As you can see for the limiting point M on the power flow map, I think that is the 55 percent core flow point, our power density is 43.3, at that point. That is megawatts thermal million pounds per hour as a rated power. And I'm sorry, at Point M, it is 51.86.

The Redundant Reactivity Control System for the automatic start is on high reactor pressure. So, for analysis purposes, we used 1095 psig. And the nominal delay setting is 98 seconds. That system has, it is a digital logic so there are digital timers. There is minimal setpoint trip but we do, in the analysis, we use 120 seconds for that initiation delay, rather than the 98 seconds.

Now for the runback, it is also on high dome pressure. Now, of course, these are coincident with the APRMs not downscaled. They are greater than four percent.

For the runback, it is a nominal delay of 25 seconds. And again, there are digital timers and analytically, we use 33 seconds.

MEMBER CORRADINI: Sorry I don't know. What does not downscale mean? I guess I interpret it to mean that you have got a coincident signal of

pressure and power but what does not downscale imply? I didn't get that.

MR. CIFONELLI: The downscale setpoint for the APRMs is four percent. It is the relay kicks up.

So, on initiation of a reactor scram, the rods don't go in or a portion of the rods go in. The power does not come down below four percent --

MEMBER CORRADINI: Per predictor. Okay.

MR. CIFONELLI: -- if it does not trip that downscale setpoint.

MEMBER CORRADINI: Oh, so this is total power.

MR. CIFONELLI: Correct. This is neutron APRM power.

MEMBER CORRADINI: Right.

MR. CIFONELLI: If you don't get the downscale, it triggers the timer.

MEMBER CORRADINI: Okay, thank you.

MR. CIFONELLI: High pressure, not downscale on power.

MEMBER CORRADINI: Those two coincident.

MR. CIFONELLI: The 25-second timer starts.

MEMBER CORRADINI: Okay, thank you.

MR. INCH: Now, with the runback, the RRCS

sends a signal out to the low control valves to ramp closed. It also has controls to open the min. flow valves in the feed pumps to make sure you have adequate min. flow on the pumps.

That inner analysis that occurs over 21 seconds, assuming you are at 10o percent power. So, it is a rapid runback. You know at the point that that happens, level will begin to drop and the operators will then need to reestablish control. I think Dan will go through the EOPs and how that interfaces them.

In our analysis, there is a couple of operator actions we have to assume for a MELLLA+ required to analyze the turbine trip with bypass for ATWS with instability in the dual recirculation pump trip.

Now, for the turbine trip with bypass, you still get the high pressure signal. So, the automatic runback feature still occurs. For the dual recirc pump trip, the turbine stays online, so you don't' get the high pressure signal. And for that case, our analysis used 270 seconds and we also based it on the operator taking action to try and scram the plant within the 20 seconds to get a feeling -- to set the clock, if you will.

MEMBER CORRADINI: Can I ask a question here? Because the time difference -- maybe I am misunderstanding, so correct me.

So, the automatic runback for a turbine trip with bypass s 25 -- maybe I have got this wrong. So, it seems like with a different one, we are allowing up to 270 seconds before manual operator action. Why the large difference? Maybe I am not understanding the difference between the two actions.

MR. INCH: Well, the automatic, that is the way the system is currently -- has been designed for a long time.

MEMBER CORRADINI: That I have got but I don't understand why -- what is it about the system that allows me to wait 270 seconds for an operator reaction runback. That is what I don't get.

MR. INCH: The dual recirculation pump trip for ATWS with instability is, basically, an event that we were required to analyze for the first time in any detail for instability. And I think Dan is going to talk about the EOPs and the complexity of the EOPs that you need to work through.

MEMBER CORRADINI: But give me a cheat sheet. I am still --

MR. CIFONELLI: Let me try a little bit

here. I'm not the design analysis guy but from the operator perspective, the turbine trip distracts the steam folks right away. So, my subcoolant profile is different.

And our recirc pump trip, where I don't get the automatic quick runback, if you will, in the recirc pump trip, the turbine is still online. Heating is still happening in feedwater. So, it is a slower moving instability event.

MEMBER CORRADINI: So, if I could say it back.

MR. CIFONELLI: So, there is more time before the growth -- before the onset of oscillation.

MEMBER CORRADINI: So, I saw a plot somewhere in your submittal that the realistic cool down is pretty doggone long. So, you are taking the realistic cooldown that allows you ample time to react from an operator action standpoint?

MR. CIFONELLI: That is correct. And if you didn't have that at cooldown, you would have had the high pressure and the automatic would kick in.

DR. MARCH-LEUBA: This is Jose March-Luebea from Oak Ridge. Historically, we always analyze ATWS to determine trips or MSIV closure because that is what is more damaging to the core.

Right?

But when we analyzed Nine Mile Point with the automated actions, the ATWS high, turns out it did not oscillate at all.

So, when they were doing analysis to figure out that the limited output was a much lower level of activity, a very mild output, it was a two-pump RPV with a turbine open, which has never even been analyzed before --

MEMBER CORRADINI: Anywhere else.

DR. MARCH-LEUBA: -- anywhere else, simply because it is so mild that you do not have to analyze.

Now, in this two-pump RPV, you are not supposed to scram until the oscillations develop and then the operator sees oscillations and pushes the button. The ATWS starts there, when the rods won't go in.

MEMBER CORRADINI: Oh, so from a timing standpoint, everything is delayed.

DR. MARCH-LEUBA: Everything is very slow and of course the cooling transient in the two RPV is much milder. So, the selections are much milder.

MEMBER CORRADINI: All right. So, let me ask, since you happened to volunteer this information.

So, if I look at other designs and other

things we have looked at, this is a whole lot different and part of it is the feedwater setup and the characteristic time of cooldown, I assume, is driving this.

DR. MARCH-LEUBA: And the final temperature.

MEMBER CORRADINI: And the final temperature. Okay. All right, that's what I thought but I wanted to make sure because there is a really big difference.

DR. MARCH-LEUBA: With a turbine trip, you end up with the temperature of the condensate as time, which could be as low as 68 degree Fahrenheit.

With the turbine running after pump trip, you end up with a reduction in fuel water of only 50 to 80 degrees but you have less.

MEMBER CORRADINI: Okay.

MEMBER SCHULTZ: And then the manual scram within 20 seconds of the dual recirc pump trip, that happens after the pump trip, 20 seconds after the pump trip is the expectation for the scram?

MR. CIFONELLI: That's correct.

MEMBER SCHULTZ: And then there is plenty of time to initiate the feedwater runback.

MR. CIFONELLI: That's correct.

MEMBER SCHULTZ: Thank you.

DR. MARCH-LEUBA: This is Jose again. On that 20 seconds, it sounds very fast but all the analysis assumed that the operator has to do it but it fails. So, no credit is given for that action.

MEMBER BALLINGER: We have another number that we have been hearing time and time again, which is 90 seconds.

DR. MARCH-LEUBA: That is for feedwater reduction.

MEMBER BALLINGER: Is the 270 seconds the equivalent of the 90 seconds?

DR. MARCH-LEUBA: Correct.

MEMBER BALLINGER: Okay, that is what I was trying to get at.

MEMBER CORRADINI: But what confused me is essentially the setup of all the cooldown conditions and the assumptions and other things we have seen.

MEMBER BALLINGER: Right, especially the feedwater temperature.

MEMBER CORRADINI: Correct.

MR. CIFONELLI: In the closed session, we do have some of those details.

MEMBER CORRADINI: That's fine. Just, since you brought it up.

MEMBER SKILLMAN: George, for the two automatic actions, the 98 seconds and the 25 seconds, how often are those tested?

MR. INCH: The testing for the Redundant Reactivity Control System, that logic is tested on a refuel outage basis.

MEMBER SKILLMAN: Every 24 months. And how about the operator actions? How often do the operators rehearse that and demonstrate their competence?

MR. CIFONELLI: The ATWS event is practiced often in this simulator. I don't know if I have a number to give you. The time critical operator reactions were validated. And I am going to talk about how that validation occurred.

Revalidation is required every five years.

MEMBER SKILLMAN: Thank you.

MR. INCH: I'll be going into some more detail with what we just sort of entered into in the closed session.

So, in the licensing basis ODYN analyses, we do credit the automatic features that we just spoke about. That was true for extended power uprate and it is also true for the MELLLA+.

The limiting event is the pressure

regulator failure to open. And for MELLLA+, the peak pressure and PCT, they are very close. They are essentially interchanged.

The peak upper plenum pressure, which is largely governed by the SRV setpoints, there is a small variation there, are also very close.

And the time to hot shutdown is reduced because of the boron-10 in our licensing analysis.

The boron-10 also improves our margin to the HCTL limits for the suppressionable temperature. And our analyses and submittal are based on the allowance in the MELLLA+SER limitation in Condition 12.18.b that eliminates the need for a best estimate TRACG containment evaluation for HCTL because we have implemented the boron-10.

We have essentially, our suppression pool is back to what it was with the original licensed thermal power at 75 percent core flow, which is the limitation and condition.

Our peak containment pressure is reduced from 7.0 to 6.5 pounds, our design limit is 45.

And from a practical standpoint, Dan, you know your experience in the simulator, which we have updated the simulator and benchmarked it to make sure it can reproduce the ATWS licensing bases cases, and

our experiences with those realistic scenarios that you are achieving hot shutdown prior --

MR. CIFONELLI: That's correct, which - and I'll talk more, as you know, about that.

MR. INCH: We've also - there's a margin of improvements in terms of the redundancy. Because of the Boron-10 we can now satisfy the boron equivalent control capacity requirement with one pump at 40 gpm, and we've also completed supplemental analyses that show we meet all of the licensing basis criteria with the single standby liquid control pump.

I'd like to - the test matrix, if we could put that up? Here's our MELLLA implementation and test matrix. We've got - there's also a flow chart that we can kind of look at together with this hopefully in your handouts.

Test condition two is probably pretty much the first one we get to, which is where we're going to do the pressure regulator dynamic testing as we come down. So we'll be coming down to test condition two, then to test condition three on the MELLLA boundary, and taking data as we reduce core flow in the MELLLA boundary.

For all, you know, stability monitor performance, steam separator performance, we'll be

taking radiological monitoring data for comparing it and neutron surveillance data at these points. And then at test conditions two and three, we will do some dynamic testing as a baseline for MELLLA+ and then we'll enter test condition five which is the 55 percent core flow.

You can see we maintain approximately a two percent margin to the MELLLA+ boundary. And then we'll also repeat the dynamic tests at test condition eight, and then again at test condition 11 as we come up.

They will be - all along those we'll be also collecting the steady state data. As you can see, the separator performance is done at one, three, five, eight, and then back at test condition 12.

We'll be taking stability performance data. What that means is they'll be downloading data from PRNM and then GE will be using that to analyze APRM noise and the OPRMs.

That's - we expect that testing to take approximately five days, five to six days, and it's currently slotted for the second week of September. It's - you know, obviously we need to take an extended down power to maneuver the plant and there's fixed windows of opportunity when that can best be managed

for the plant so, you know, changes in schedule will have an impact on us.

The last thing I wanted to go over was the --

MEMBER POWERS: Before you go on too much, could you remind me again what are the data that you will collect in each of these tests?

MR. INCH: Okay.

MEMBER POWERS: And given that each test is a single test at a prescribed set of conditions, how will you assess the variability of that data?

MR. INCH: Well, for the dynamic tests for example, what we're looking at is the impact of the rod line on the control system response. So it's controlling pressure and also reactivity with levels. So on the higher rod lines, there could be an impact.

MEMBER POWERS: But what I'm trying to understand a little better, you say, "Okay, I'm in these conditions and I want to assess on the control," what is it exactly that you will measure? I mean, what is the assessment?

MR. INCH: Okay, so for the feed water level control we're looking at the control systems' decay ratios and also the potential for any power changes related to level oscillation. So, you know,

you change the feed water level, you change reactivity, and there's a feedback loop, so its primary decay ratio and margins on any flux response.

The same thing with pressure as the reactor control is a control variable. So if the control - and there's a feedback loop through the core. So as you make a pressure change, you're going to see on a higher rod line more reactivity. So we're looking at stability of the regulator and also margin to - on neutron flux to any flow bias lines.

For the moisture carryover, we'll be monitoring just that, you know. We'll be taking measurements in the condenser for sodium-24 and then comparing that to the design limits and trending it as we go down.

For the - you know, we're a hydrogen water chemistry plant, and that - for that test we're looking primarily at main steam line dose. So, you know, I had a slide on some operating experience on that.

The - we're taking baseline data for the stability monitor. Juswald, could you speak to the - how - what GE does with that?

DR. VEDOVI: This is Dr. Juswald Vedovi from GEH. Yes, for as far as stability, we're going

to pull that OPRM cell signals, so these are the amplitude, relative amplitude confirmation counts, periods that are available for each OPRM cells from the OPRM system.

We vary the resolution around 100 milliseconds and we use those as confirmation of the additional data that we review in a number of cycles for different plants like Nine Mile Point 2. So we use that to confirm that the noise level in the plant is in the range of what we assessed.

MEMBER POWERS: Well, I might add that may be good enough. Let me ask this question. You come back to TC 8, okay, you make these measurements. Now, if tomorrow afternoon I redid the test, made exactly the same measurements that you did there, how much variability would you expect?

MR. INCH: We're making - we wouldn't expect much at all. What we're trying to do is establish - well, we're establishing a steady state test condition at a power flow point. And what we're really -

MEMBER POWERS: You're controlling a lot of things. You're not controlling everything on the face of the planet, okay. So some things are - you're just not controlling. I mean, you have no control,

okay, and there are things that you don't know enough to control. How big is the variability in the result?

MR. INCH: I'm not sure what variables that we're not controlling that would -

MEMBER POWERS: The day of the week.

MR. INCH: Hmm?

MEMBER POWERS: The day of the week, the ambient atmospheric pressure, the spinning element of the earth that particular day, something that has an influence that you just simply don't know.

MEMBER CORRADINI: I think Dana is asking a question, so do you do any repeatability at any of these points? So in other words, you come to do TC 5 tests I think or one of these, and you come back and you'll return to do TC 5 on another day to see - just to confirm your expectation that you get the same result. That's what I think he's asking.

MEMBER BALLINGER: Dana's not being facetious. We're really trying to get after this variability and uncertainty that we've been talking about.

MR. INCH: What I'd like to do is take that and get back to you on that, and we'll talk about it in a closed section because I'm not sure which variables you're referring to, so if you give us -

MEMBER POWERS: Well, I mean, things that you simply don't know. I mean, it's not your fault. There are always things that people don't know.

MR. INCH: So what our plan is doesn't include that. I think our assumption is that we're - we are making sure that the reactor's truly at a steady state condition.

So from the reactivity standpoint, we have established, you know, stable power conditions. We're not in the middle of a xenon transient for example. And then we're making sure that feed water temperature is within a normal band that's no longer changing. Pressure is under control. Water level is under control.

So for that power state point, the balance of the plant is confirmed to be within the band where we would say yes, you're at, you know, a normal steady state initial condition for that power flow point.

We would expect that to be repeatable and not, you know, subject to arbitrariness because you know, you have to control core flow. You have to control the rod pattern and pressure level, temperature. Those are the key variables and they're all tightly controlled.

MEMBER CORRADINI: So can I try it another

way because I have a feeling this is a tough test to do? So another way that I might answer it is I get to TC 5 one day and I don't get to the exact TC 5 the next time.

In other words, I don't get exactly the same flow or the same power with everything being identically the same. So that's my expectation, but if I try to repeat the test, to repeat it precisely would be a tough thing.

That would lead me then to ask the question, okay, so then you've done some sort of uncertainty propagation through your measured variables and you - and the GE folks have said once I look at one test and I look at the oscillatory behavior coming out of that test, and the decay ratio, etcetera, etcetera, within some confidence level I feel good about what I've measured. That's the other way of attacking it. That's what I was expecting.

MR. INCH: I think that's the right answer. We've been given from GE the test conditions to run at. We didn't make these up. These are also described in the LTR. And in that specification there is a condition - how close you need to be, what our uncertainty is.

So for example, that two percent within,

you know, close to the rod line, and I think we're controlling it within one percent on flow, and those then establish the issue of condition such that it is repeatable. But are we testing the repeatability? No, that's not in our plan.

MEMBER SCHULTZ: George, one thing that could help is this afternoon if you could go over the test matrix and display that, that could perhaps shed some light on what the range of information is being established at each of the test points.

And secondly, perhaps GE could discuss - we always see these test matrix, but we never see the result in terms of the answer to this question. What variability does one see? Did you get the test results that you expected? And are there any confounding uncertainties in the testing that you're working on?

So perhaps if we can address both the range of test conditions and the matrix, as well as the results which have been seen in past tests or expected in this test, it would help.

MR. INCH: Okay, it just occurred to me one thing we are doing is we're - we are repeating the EPU test that we did in 2012 as one repeat test that we're going to do. So that is -

MR. KHAN: And at TC 2, and really all of these tests, I know it doesn't really answer your question, but they are very similar to the tests that were performed for extended power upgrade.

CHAIR REMPE: So this is some of the areas for inspection then that is submitted to the NRC which - before you were - as part of the MELLLA+ implementation? The section 4.4 and the draft SE, is this what you document and submit to the regulator?

MR. INCH: The results of them?

CHAIR REMPE: Yes.

MR. INCH: Right now the LTR doesn't require us to submit the results of the tests. It requires us to perform them and they're available for audit, but -

CHAIR REMPE: But this is the test in the areas for inspection that you're referring to in section 4.4, or what is done for 4.4?

MR. THOMAS: This is George Thomas. Because they have done part of testing in the EPU type, there was not currently any additional testing requirements actually.

So in the Monticello SER, we were silent about the testing, but they get into some trouble in the test data. And then the data, they couldn't find

the lead in the SER, so we kept telling something for the testing in the SER.

And because of the testing problem, we actually put a paragraph telling that, you know, that that's okay, and if get into trouble, they cannot really go and implement the MELLLA+ without completing all of the tests.

CHAIR REMPE: So what do you expect them to do to meet this requirement or this information here about the full implementation of MELLLA+ with only partial testing will not be acceptable?

MR. THOMAS: We follow that through our original leads and the regional staff. If they get into any trouble with any testing, we wanted to make sure they won't stop MELLLA+.

CHAIR REMPE: But, okay, they're saying, well, it's only open for inspection. We don't have to submit it to the regional inspectors, and now you're saying well, they do need to - the regional inspectors need to look at something. And how will they evaluate whether it's acceptable or not is what I'm trying to get to here?

MR. SAENZ: This is Diego Saenz. So they'll have acceptance criteria for these tests and we expect that if they don't meet their acceptance

criteria, they would follow this with their corrective action program, and the inspectors follow the corrective action program.

CHAIR REMPE: And what are the acceptance criteria? Because they've just said, well, we look for stability. I mean, it does sound like we're talking about the same tests here, but -

MR. INCH: Each one of the tests has acceptance criteria. So you know, the stability, the decay ratio is one of the criteria. Moisture carryover being less than the design limit is a criteria.

The - for APRM noise, one of the tests we do to make sure that the APRM noise on a higher rod line is bounded by our calc assumption, that's a criteria. So each one of these tests has - especially the dynamic testing has criteria.

So for pressure and level it's decay ratio on pressure and level, the controlled variable. So that's all in the test plan, test spec from GE, and incorporated into our test procedures from that. And then the test procedures and the results are going to be a formal program test procedure.

It will run through our plant operations review committee for approval, and then any - like you

mentioned, any test criteria failure would then result in an instant report in IR which would then have to take corrective action.

CHAIR REMPE: So is the phrase about full implementation still valid? I mean, have they covered the entire - you guys agree on what's an acceptable range here of tests to be performing?

MR. THOMAS: Yes. No licensee is going to start the plan without completing all of the tests. But still, we make sure that MELLLA+ will have a paragraph like that.

MR. INCH: The way we understood the draft SE was if you're going to operate in the MELLLA+ region you need to complete this test plan, and that's what the LTR says.

And if for some reason we couldn't, we could only partially complete it, that - we'd be in no man's land. You'd have to - I think you'd have to talk to the regulator as to what we could do at that point.

But right now, it's our understanding that to operate in the MELLLA+ region we need to complete these tests.

MR. GOODNEY: But we wouldn't be operating there. We'd move back down below the MELLLA line and

that's where we'd stay until it was resolved.

CHAIR REMPE: Okay, thank you.

MR. INCH: The last thing I wanted to cover was some OE that - from Monticello that we looked at. It's the only other plant that's implemented MELLLA+ at this point. And what they experienced was an unexpected main steam line high radiation alarm when they were coming down in flow.

And at the reduced core flows you will get an increased N 16 on main steam line. And when you're on hydrogen water chemistry, you're injecting hydrogen in, and depending on what that rate is you can have an increase that's not necessarily proportional to the power change depending on how much hydrogen you're putting in.

So we've studied that data and one of the things that Nine Mile, when we did power operate, we did run an optimization ramp test on the hydrogen injection to optimize that rate.

And there's basically a knee on the curve with - when you're implementing noble metals if your hydrogen injection rate is still meeting the 4 to 1 ratio and you blow the knee, you don't see a large change in the main steam line dose.

So our expectation is that we're going to

be below the alarm. We will be monitoring it as we come down. So that was the one piece of OE that, you know, did have some relevance to Nine Mile.

So that concludes the open session discussions that we had planned.

MR. CIFONELLI: Mine's next.

MR. INCH: Oh, I'm sorry.

MR. CIFONELLI: For you.

MR. INCH: For me. Dan Cifonelli is going to go through the -

MR. CIFONELLI: Good morning, I'm Dan Cifonelli. I'm an active senior reactor operator at Nine Mile Point Unit 2, and a shift manager, and I'm currently assigned to assist with MELLLA+, along with I still perform relief functions in the control plan and shift management.

Today I plan to talk about a summary about technical specification changes, the power to flow map changes, operator actions, our ATWS strategy, time critical operator actions, and our training that we've performed to support the MELLLA+ implementation.

This slide provides a high level summary of the gamut of technical specifications required to implement MELLLA+. We've already talked about a few of these.

I want to point out that number two, particularly with respect to the boron enrichment to 92 percent concentration, has been a really well received change in the plant that the operators are experiencing. It significantly slows down the ATWS event. Our hot shut down boron time has been reduced from 16.4 minutes to four-and-a-half minutes.

So the operators have really grabbed onto the use of this tool, if you will, and always have used boron but now they're - it teaches itself for using it when the operators' promptly inject boron prior to the automatic operation.

They are positively reenforced on the scenario because they're able to shut the plant down very quickly avoiding the long term heat addition to the containment.

MEMBER SKILLMAN: I appreciate the reactivity of the higher boron presence, but I do ask why an only 8 psig increase in pressure makes a difference?

MR. CIFONELLI: Well, I think George can answer it better than me. The ATWS analysis, peak pressure has come up just that amount so we were required to make the change in our tech spec number because the heat pressure is slightly higher.

MR. INCH: So you're asking why it was only 8?

MEMBER SKILLMAN: It seems almost insignificant -

MR. INCH: It is.

MEMBER SKILLMAN: - in the span of that pressure.

MR. INCH: It is. We agree.

MEMBER SCHULTZ: But the change in pressure is due to an analysis result -

MR. INCH: Right.

MEMBER SCHULTZ: - associated with the ATWS event.

MR. INCH: Yes.

MEMBER SCHULTZ: So you see that and then the tech spec needs to be changed to match the analysis.

MR. INCH: Right, the - I think - is Craig - Craig, could you speak to the analysis peak pressure results that we have? Because the peak pressure of 1372, and we're going to go into proprietary session I think, is governed primarily by several aspects of the analysis. Maybe we can get into it later.

So, you know, it is a small change, and we would expect it to be small.

MEMBER SKILLMAN: It appears to me to be almost cosmetic and just in alignment with analysis. It seems to have no real practical impact on the rate at which the boron is injected.

MR. INCH: The most important part of it is, you know, relative to the standby liquid control pump pressure, and I have a slide on that where small changes could be important for that. For Nine Mile it's not so much, but it is - that's why there's a tech spec change for that.

MEMBER SKILLMAN: I'd like to see that slide at some point.

MR. INCH: Okay.

MEMBER SKILLMAN: Okay, thank you.

MR. CIFONELLI: Item five is the tech spec requirements for when our OPRM algorithm is inoperable for an automatic RPS trip. OPRMs are required to be operable, and if they're not, operations in restricted.

Immediate action is required to implement the manual backup scram protection, and 12 hours to implement the automatic backup scram protection, and a report to the NRC is required within 90 days to discuss the corrective actions that are scheduled for completing those.

If the automatic backup scram protection cannot be implemented, then operations is further restricted to below the backup's ability protection boundary line, which is the 50 megawatts per millions pounds mass per hour line, and it's depicted on the power-to-flow map on the next slide.

The next slide is the power-to-flow map that is used by operations to maintain the plant within its required operating domains. We have a number of procedures that reference this graphic. The graphic is used by operators for startup, shutdown, normal activity maneuvers, and response to transient conditions.

The power-to-flow map is two foot by three foot laminated. The power-to-flow map is not anything that's new to the operators. It has been redesigned by the MELLLA+ project team. And in January of this year we presented it to the operators in a draft form.

And the interest was in receiving their feedback and comments to ensure that the nomenclature, the color coding, the lines were just the way my operators wanted to see them in terms of human factors, to ensure a good assimilation to the new regions. We kept a lot of familiarity with the colors and the lines to assure an easy transition to the

MELLLA+ operation.

MEMBER SKILLMAN: Dan, let me ask this, in your operator training, are the operators required to reproduce this from memory?

MR. CIFONELLI: No.

MEMBER SKILLMAN: Why?

MR. CIFONELLI: There's - I would think that the complexity of information is not something that - I don't want my operators to have to memorize in a transient. I prefer that they refer to the procedure.

MEMBER CORRADINI: They have some sort of plastic map of this I assume?

MR. CIFONELLI: Yeah, this is - there's a two foot by three foot laminated copy at the front panel of the control room, and we use marker to mark and map where we are on the power-to-flow map. There are some set points on the power-to-flow map that the operators are familiar with.

When we reduce recirc flow to minimum, they know that means don't reduce recirc flow to less than 55 million pounds mass per hour, and that's unchanged, and that is the knee of the curve on the new MELLLA+ map.

So there's no - I wouldn't want my

operators to make an error when they're manipulating the plant and try to do some of the more complicated manipulations that we use for the power-to-flow map from memory.

MEMBER CORRADINI: Can I ask about this because I am trying to compare the two from the next slide? But the yellow region means if I stray into the yellow region I have some time window that I have to get out of the yellow region whereas the red region is scram?

MR. CIFONELLI: That's correct.

MEMBER CORRADINI: Okay, and you're eventually going to get to the next one, but in that one there's more red, so I'm trying to understand the difference, and you'll get to that?

MR. CIFONELLI: Yes.

MEMBER CORRADINI: You've essentially taken the K region and turned it red, so I'm trying to understand.

MR. CIFONELLI: The yellow exit region in our normal power-to-flow map is region two, which is the controlled entry region per the GE analysis. We've elected to approach that more conservatively and call it an exit region. So for instance -

MEMBER CORRADINI: So if they get

themselves there, they've got to get out?

MR. CIFONELLI: If they get themselves there they have to get out whether the OPRMs are operable or not, and that's the purpose of this slide is to show you. One of the purposes is to show you the conservative implementation that we're using. So they do have to get out if they're in the exit region.

And our normal operating procedures have that redesign to not get into the region when we're starting up the plant. For instance, Line Golf is 58 percent rod line. That's our maximum rod line for upshift of a recirculating pump.

It was originally 61 percent and we dropped it down to 58 percent so that we avoid the controlled entry region by design but we're training our operators to not go into that.

MEMBER CORRADINI: So what you just said, just so I get it right, if I take the Golf Line and I go all the way down to essentially 25 percent flow, if I was at 58 versus 61, I'd be in the yellow which would essentially, the way you've described it, you don't want to be there at all.

MR. CIFONELLI: That's sort of correct.

MEMBER CORRADINI: That's okay, sort of correct.

MR. CIFONELLI: Yeah, I wouldn't necessarily be in the yellow, but I can certainly assure that my operators will not get in the yellow when they're performing that plant manipulation -

MEMBER CORRADINI: Okay.

MR. CIFONELLI: - by restricting the start of the manipulation to where the 58 percent rod line intersects with Line Bravo.

MEMBER CORRADINI: Okay, thank you.

MR. CIFONELLI: Going to the next slide, so the operators have two power-to-flow maps for duel operation available to them in the control room and this is the second one.

The difference, as Michael pointed out in the first, in the second one, is primarily the scram region which is defined by Line Kilo, K. Line K is region one of the manual backup stability protection solution, and if we unintentionally find ourselves in the red region, the operators perform immediate scram of the plan.

The other difference in this power-to-flow map is the Line M or Mike, and we've talked about that a little bit already. That's a tech spec required line that restricts power above the 50 million pounds, 50 million megawatts per pounds mass, which is called

the backup stability protection line.

So if OPRMs are inoperable and within 12 hours we cannot implement the automatic backup stability protection, then we would also further restrict ourselves to Line Mike, and we've included that little sliver in the yellow.

This power-to-flow map also has another graphic for the operators and it's down in the lefthand corner of the slide. That depicts the automatic backup stability protection which is used in the pneumatic power range monitoring system.

If the OPRMs are inoperable, the operators have an off-normal procedure to dial in new set points for the signal to thermal power scram that would include that red region that, by the way, bounds the Kilo line on the manual map, and provides a direct RPS scram signal if that region were entered.

The blue area, just to point out the blue area on this line, is a buffer zone, if you will. It's what we call the heightened operator awareness zone and it serves the purpose of warning the operator that they are approaching or nearing an exit region.

We are allowed to operate in that area, but my procedures minimize the time that we would want to park ourselves and stay in that region. And on a

transient if we were approaching that region, it would warn the operators that they will soon have to take action if conditions were to further degrade and they were to find themselves in the yellow exit region.

So that's the tool that the operators currently use. It's very similar to the option three manual actions. We kept it as similar as possible so that the operators have familiarity with the same type of concepts. And our off-normal procedures are designed around the new power-to-flow map.

We also note - one thing also that is good to note on this map is the - where the OPRMs are armed. You can see the solid red lines that go horizontally and vertically. The horizontal line is at 23 percent power and the vertical line is at 75 percent flow. Those are the set points that arm the DSS-CD solution RPS cycle.

MEMBER CORRADINI: So why isn't it armed at 85? Maybe I don't appreciate that. Why the 10 percent pull back? Why is it not armed on the vertical line at 85 versus 75?

MR. INCH: Oh, the basis for the 75 percent core flow, I think GE would answer that.

MR. CIFONELLI: I just assume that - our current is 60 percent flow and 30 percent power, so

this is a change. The option three solution has a similar arming region where your ratio - these guys can explain better than me.

DR. VEDOVI: This is Dr. Juswald Vedovi from GEH. The starting core basis for the OPRM able regions has been around 60 percent core flow and 30 percent power.

However, those region were subject to being validated on a cycle specific basis to the extent where the backup stability protection exit region will be because it does change from cycle to cycle.

And since the boundaries are in the tech specs, when we develop the DSS/CD we decided to increase the region conservatively so that it would not depend on a cycle specific basis to check and having expanded and having to add a modification in the tech spec.

MEMBER CORRADINI: So if I can say it differently, this relieves the burden of every time I have a cycle, the cycle will change.

DR. VEDOVI: Correct.

MEMBER CORRADINI: Okay.

MEMBER SKILLMAN: Dan, let me ask this, you've got two maps. Are both maps in front of the

operators at all times?

MR. CIFONELLI: Yes, they are.

MEMBER SKILLMAN: And how does the operator know which map he or she is supposed to be focusing on?

MR. CIFONELLI: It's simply on the basis of the status of the OPRMs. Typically, the OPRMs inoperable map is not used. The history of having option three for several years, we've never had to use the OPRMs are inop map. So the display on the front panel is primarily the normal display.

The operators have the ability to pull out the other plexiglass and plop it down on the main control console if OPRMs become inoperable to use it in that case. The primary map is actually kept and more prominently displayed to the operators.

MEMBER SCHULTZ: Prominently and permanently displayed it sounds like?

MR. CIFONELLI: Correct.

MEMBER SCHULTZ: And the other one would be pulled out and used otherwise?

MR. CIFONELLI: That's correct, but it's right at the controls area.

MEMBER SKILLMAN: What I think I'm hearing you say is only when the OPRMs are inoperable do you

use the other map. For all other times you use the primary, and the operators are very well aware of the difference between those two circumstances.

MR. CIFONELLI: That's correct.

MEMBER SKILLMAN: Thank you.

CHAIR REMPE: Dan, even though it's less efficient, it looks like you have several more slides. Do people want to take a 15 minute break or just keep plowing through? Is everyone okay to - okay. Okay, then just if you guys are okay, we'll keep going, okay.

MR. CIFONELLI: The next slide is a summary slide of the procedure changes that we've prepared for readiness for implementation. The bullets are like emergency, off-normal, and OPRMs inoperable that we've talked about, and the gamut of 27 procedure changes that the station has prepared for implementation.

The first bullet is the strategy for lowering level to combat an instability event, and it's been an operator strategy for ATWS mitigation since Rev 1 of the EPG/SAGs were introduced, and the strategy continues today in the MELLLA+ domain.

It works and it's the same strategy the operators have been using for a number of years. So

our emergency operator operating procedures are unchanged.

The next bullet talks about our normal and abnormal transient procedures. And as I've already talked about a little bit, the major change is in the definition of the regions which we navigate through and maintain ourselves in the operating domain, and the references in those procedures and the power-to-flow maps to different lines on the power-to-flow map that have been redefined for MELLLA+ operation.

So conceptually for the operators there is not a complex change for them. It's an understanding of - Line Kilo had moved a little bit and Line Lima has moved a little bit on the power-to-flow map.

The MELLLA line is a straight line whereas the MELLLA+ region has a 55 percent flow if you go back to the flow map. You see at 55 percent flow it has the vertical line into it. So for instance, our rapid power reduction procedure restricts rapid power reduction using recirc flow to prevent entry again into the yellow region.

So if we were to have a loss of a feed water pump online, and we usually have two feed water pumps running in operation, if a feed water pump were

to trip, currently I can come all the way down - I'm sorry, let me back up a little bit, not if it trips.

If I want to put the plant in a place to set myself up for a rapid removal of a feed water pump, currently I could pump to the place I need to be which is approximately 68 percent power using recirc flow alone.

Now I'll be limited to 55 percent flow, and then the operators are directed to insert scram rods to go around the knee of the curve, if you will, and then lower flow further to get to 68 percent power if necessary for rapid removal of a feed water pump. So that's an example of how we've changed some of our off-normal procedures.

The third bullet we've talked about which is the operator actions for when OPRMs would become inoperable, and the fourth bullet just represents the total procedures that have changed.

The procedures that have changed are operational, reactor engineering, and instrumentation and control procedures for set point changes. Again, there are 27 procedure changes and they're all ready to go.

MEMBER SKILLMAN: How have the operators been trained on the changes?

MR. CIFONELLI: I have a couple of slides. The next slide provides a little bit more detail of the standard contingency five that the EPGs practice for ATWS scenarios. There are three level bands that are generally used in the contingency in an ATWS condition. The first level band is very broad. It spans from -39 to 202.3, and those are our plant specific numbers.

What they are the - -39 is the minimum steam cooling water level where adequate core cooling is accomplished by both submergence and steam cooling, and the top of the band is the turbine trip and the feed pump trip set point.

So when power is less than four percent or down the scale, the guidelines for an ATWS mitigation is to allow a large level band. In that case, there is not enough driving force of power to create an instability of a wide variety.

I'd say the more band of interest for MELLLA+ operation is the middle band. The middle band is specifically designed for thermal hydraulic prevention, and it lowers level below the feed water sparger which allows preheating of the feed water and reduces subcooling, and subsequently reduces the reactivity addition by subcooling the water.

This band spans from the minimum steam cooling water level up to two feet below the feed water sparger. The typical order that the senior reactor operator gives when he's in the ATWS event will be name Dan or whoever, "Lower water level to less than 100 inches." When level drops below - I'm sorry, it says terminate and prevent injection when level is below 100 inches, major level band 50 to 80 inches.

50 to 80 inches is a scripted band we use in our transient mitigation guidelines, and it allows margin to the sparger on the top end, and on the bottom end it allows margin to main steam line level one isolation.

In parallel, the operators are doing numerous other things, controlling pressure using - generally using SRVs, defeating the high pressure core spray pump from injecting because that's not allowed in an ATWS, high-powered ATWS event, taking actions to defeat the level one main steam line isolations, injecting standby liquid control, and lowering water level.

This band is given in the Charlie 5 contingency procedure with the - by the senior reactor operator, and the reactor operator would use good

three-way communications before he takes action to lower water level in the reactor.

The third band is if things get worse and we're adding heat to the containment. In this case APRMs are still upscale, and since we're adding heat to the containment, we will reach our boron injection initiation temperature which is 110 degrees at Nine Mile Point Unit 2.

So if we were to get to 110 degrees in the suppression pool, levels would lower further to the top of active fuel down to the main steam - the minimum steam cooling water level, and this is to drive power low to prevent further challenging of the containment, and we're here controlling level at the top of active fuel essentially.

So that's our level control strategy in a variety of ATWS situations, including the couple that were evaluated in MELLLA+.

The next slide is the gift that I got from MELLLA+, two new time critical operator actions. The two were already presented by George. They are 20 seconds to place a manual scram in case of an ATWS, particularly the duel recirc mode trip.

And the second is the 270 seconds to get to that step where we say terminate and prevent

injection, and the operator uses a flow controller to close the feed water regulation valves.

The actions were validated in September of 2014 per the Exelon procedure for time validation of critical actions. It's a fairly rigorous procedure that a team was assembled to design the validation process.

And I used natural operating crews in a training cycle. Four crews were time validated. And we also did some sensitivity with regards to minimum staffing. We observed the crews performing these actions in a minimum staffing level.

The results were that the timing is not affected by minimum staffing, and this is because they're high priority actions. They're taken from the front panels of the control room and they're single switch type actions. So the staffing levels had no impact on the data.

MEMBER SKILLMAN: Dan, the 20 seconds to use the mode switch has, as I interpreted them, an important connotation. You can do a manual scram by hitting your scram button, but when you use the mode switch, you are actually enacting a number of other processes. Is that what you're trying to communicate here?

MR. CIFONELLI: No. I'll say yes and no. Let me try to answer that fully.

MEMBER SKILLMAN: The mode switch does more than just scram the plant.

MR. CIFONELLI: Correct.

MEMBER SKILLMAN: It opens up a whole bunch of other logic.

MR. CIFONELLI: We want to use the mode switch. That's the way we've been doing it since the plant start up, doing that, scramming the plant as the initial. We want to put the system in a shutdown configuration. So those other things that happen are good things for a shutdown plant.

For instance, they defeat the main steam line closure on low pressure. So the mode switch is the best way to initiate a scram, a manual scram. The push buttons for RPS are also available to the operator, and they're an initial contingency action if the mode switch fails to insert a manual scram.

The mode switch has a set of contacts that are tech spec required manual scram contacts, so the mode switch in a shutdown position does input to the RPS circuitry a manual scram.

MEMBER SKILLMAN: Thank you, I was just confirmed that that's what you meant. I got it.

Thank you.

MR. CIFONELLI: Okay, the next slide is the results of our validation process. The 20 second requirement we met with a significant margin. 8.5 seconds was the average time with a span of five to 16 seconds. The 270 second time, we came in at 71.5 percent with an average time of 193 seconds with a span of 150 to 232 seconds.

The operators were not given any special training to do this. This is their current proficiency, if you will. I didn't hoist them up and we didn't give them any new goals to reach. We didn't give them any new expectations. This is an action that has been instilled in our operators for a number of years.

Previous to MELLLA+ we did not have it as a time critical operator action. MELLLA+, the analysis requires a time critical action, so we included it into our program, and we found that it's achievable under our current proficiency.

The validation reports were submitted on the docket to NRC, and the NRC audit also confirmed the proficiency of the operators to perform these actions.

CHAIR REMPE: So that was in November,

right? And what kind of times did they get during the audit? Was it close to the average? Was it -

MR. CIFONELLI: I don't have those times. They were less than 270 seconds.

CHAIR REMPE: Okay.

MR. CIFONELLI: The next -

DR. MARCH-LEUBA: We're asking around here in the staff - Jose March-Lueba, Oak Ridge - and we don't remember the numbers, but certainly including the most region to shutdowns really fast. The typical response time is four to seven seconds for that. I've timed that one before. Now the long term, I don't remember.

CHAIR REMPE: Thank you.

MR. CIFONELLI: The next slide's purpose is to show the maintenance of these times. The program, Exelon program for managing time critical operations are consistent with regulatory guidance. The two biggest processes that could affect a time critical action are a design change or a procedure change.

And waxed into the processes are checklists that require you to address time critical actions. So both engineering and procedure writers are required to look at all time critical actions when

they're making a change, and we revalidate every five years all time critical actions.

The next couple of slides is a summary of our operator training. We, early in the process, we assigned an operator, qualified operator trainer to the project to help us, and he's here today, and he's done an excellent job helping to get our operators prepared.

We started about a year ago and introduced the MELLLA+ concept. We had - we brought Juswald up and he helped with the DSS/CD solution, and our operators were trained on the new algorithm. And we went over thoroughly the proposed technical specification changes.

Then again in August 2014, we started our simulator testing where we exposed the operators more to the power-to-flow maps and the ATWS scenarios starting at limiting points on the MELLLA+ line, 100 percent power, 85 percent flow, and exercised the ATWS contingencies in the MELLLA+ region for a variety of initiating events. That was the same time frame that I used for the validation of the time critical operator actions.

We also reemphasized and provided the operators with a demonstration of 92 percent atom-rich

boron. We started from 100 percent power and just turned the boron on and watched how quickly the plant shuts down.

And my final slide is more on training. In January of this year we did some reenforcement training. We provided the engineered power-to-flow maps to the operators and did ask for their feedback. We exercised more abnormal procedures.

We exercised procedures for a feed pump trip or a recirc pump trip. So those are some of the more, let's say, challenging scenarios for the operators and currently and in MELLLA+. And we did note that there was very little difference in the operator actions required to respond to those type of events.

And we went over tech specs more thoroughly. Mike provided a number of cases for the operators to study for "what if." What if we were in this condition, what tech spec would you be in? What would you be required to do? And we went through a variety of scenarios with regard to tech spec implementation.

And then in May of this year we took advantage of a recent industry event and reenforced some fundamentals. The fundamentals that we were

reenforcing were the importance of prompt insertion of control rods when they're in the active region.

We also went over the effects of subcooling on the reactor core and the potential for instabilities if you delay actions. And we also emphasized the procedures required for recognition of any oscillations and the operator actions required which is immediate scram if an operator were to observe an instability, which is observable if they're in phase.

It's a slower moving oscillation and not quite so observable if it's out of phase. You'll see some LPRMs going upscale and downscale, but quickly moving oscillation would be suppressed by the RPS signal.

And the only thing we have planned going forward is just in time training for our testing program. And we will also do some reenforcement requal training. All of the initial training is complete. We are ready for MELLLA+ implementation.

MELLLA+ will eliminate the burden of operators frequently manipulating control rods to maintain power which will reduce the probability of control rod manipulation error and related consequences such as a fuel failure. This will be an

improvement in operational safety.

MELLLA+ will allow operations to maintain additional margin to our rod line limitations and eliminate the current requirement to operate near rod line limits. This will also be an improvement in operational safety.

Based on the training given, the procedures and controls available, and the validation of the operator actions, Nine Mile Point licensed operators are ready to implement MELLLA+.

CHAIR REMPE: Thank you. So at this point let's do the public comments. So can someone check about the lines and open it up?

MR. CLOSE: Sorry, we just wanted to follow up on one point of information that Mr. Corradini asked about concerning rate of power descent and power ascension. This is Bob Close from Nuclear Fuels.

And typical for Nine Mill 2, BWR 5, is that when down powering to do a rod pull or significant maneuver, they down power to about a half a percent a minute. And if you would, reducing power to like 30 or 35 percent to perform the maneuver typically takes an hour, maybe an hour-and-a-half.

Power ascension is a different matter for

the reasons mentioned by the team. You get into your preconditioning of the fuel, right, and once you're into - reached preconditioning ramp rates, and there are ramp rates that apply for different fuel for different situations, those rates of increase would come down to two to two-and-a-half percent per hour, all right, of increase.

So nice and gentle on the way back up once they reach their preconditioned rates. But in general, power descension is, if you would, in a controlled fashion they can come down pretty quickly. All right, so just wanted to follow up on that question. Back to you.

CHAIR REMPE: Okay, so now I've been told the lines are open, and the only way we can verify that is if someone who is out there will say something to verify it. And given the fact that no one is saying anything, I'm going to assume that there's no one out there, but I'll check real quick. Is there anyone in the audience who wishes to say anything?

PARTICIPANT: Is the line open?

CHAIR REMPE: Oh, that's good. Thank you for verifying that. Okay, is there anyone out there who wishes to make a public comment? Okay, so with that, what we're going to do is take a 15-minute

break. There are 12 slides I guess for the closed licensee session, and so I would like to go ahead and push, and even if we have a bit late of a lunch, and come back here in 15 minutes, so at 11:20, and then we'll start up with the closed session, okay? Thank you.

(Whereupon, the above-entitled matter went off the record at 11:06 a.m.)

Opening Remarks

Travis Tate

Acting Deputy Director

Division of Operation Reactor Licensing

Office of Nuclear Reactor Regulation

Introduction

Bhalchandra Vaidya

Project Manager

Division of Operation Reactor Licensing

Office of Nuclear Reactor Regulation

Review Timeline

- November 1, 2013 – MELLLA+ application submitted to NRC
- Acceptance Review completed with Supplemental Information from the Licensee on January 21, 2014. Additional Supplemental Information Received on February 25, 2014.
- Revised Application Dated June 13, 2014, to reflect the completion of Implementation of changes related to Standby Liquid Control System received.
- Biweekly FR Notices Re: No Significant Hazard Determination published on June 6, 2014 and August 5, 2014.
- Multiple rounds of RAIs Issued to Licensee on the topics of Reactor Systems, Instrumentation & Controls, Human Factors, etc. Licensee responses received between March 10, 2014 to February 20, 2015.
- The NRC staff performed audit at NMP-2 on Nov 20, 2014

Licensing Actions Related to MELLLA+ Amendment

The licensee's existing license condition and the proposed technical specification changes support the MELLLA+ Application

- Proposed technical Specification change for TS LCO 3.4.1 prohibits single loop operation in MELLLA+ domain
- Existing license Condition 7 restricts Feedwater Heater out of Service by imposing a 20ºF FW temperature band

Nine Mile Point Nuclear Station – Unit 2

Maximum Extended Load Line Limit Analysis Plus

Advisory Committee on Reactor Safeguards

Power Uprate Subcommittee Meeting

June 22, 2015

Exelon Generation.

Nine Mile Point Nuclear Station – Unit 2
MELLLA+
Maximum Extended Load Line Limit Analysis Plus

Nine Mile Point Nuclear Station – Unit 2

Maximum Extended Load Line Limit Analysis Plus

Advisory Committee on Reactor Safeguards

Power Uprate Subcommittee Meeting

June 22, 2015

Exelon Generation.

Introduction

Mohamed Khan
Engineering Manager, Exelon
Nine Mile Point Nuclear Station

Exelon Generation.

Licensee Presenters

• Mohamed Khan	Engineering Manager	Exelon/NMP
• Dale Goodney	Senior Project Manager	Exelon/NMP
• George Inch	Senior Staff Engineer	Exelon/NMP
• Daniel Cifonelli	Operations Shift Manager	Exelon/NMP

Licensee Participants

• Robert Close	Nuclear Fuels	Exelon/NMP
• Ken Kristensen	Regulatory Assurance	Exelon/NMP
• Mike Smith	Operations Training	Exelon/NMP
• James Tusar	Nuclear Fuels	Exelon Corp.
• Ronnie Reynolds	Licensing	Exelon Corp.
• Bruce Hagemeier	MELLLA+ Project Manager	GEH
• Larry King	Project Manager	GEH
• Juswald Vedovi	Stability	GEH
• Craig Goodson	ATWS-I	GEH

Agenda

• NMP2 Station Overview	*Mohamed Khan*
• MELLLA+ Project Overview	*Dale Goodney*
• MELLLA+ Design and Analyses	*George Inch*
• Operator Procedures and Training	*Dan Cifonelli*

NMP2 Station Overview

Mohamed Khan

Exelon Generation.

NMP2 Station Overview

- General Electric BWR-5
- Mark II Containment
- Began commercial operation in 1988
- 24 month operating cycle
- All GE 14 Fuel Type
- Electric motor-driven feedwater pumps
- Reactor recirculation flow control valves (2 loops)
- Licensed for Increased Core Flow (ICF)
- Redundant Reactivity Control System (RRCS)

NMP2 History

Key Milestones	Year	Megawatt – Thermal (MWt)
➢ Full Power Operating License (Original Licensed Thermal Power - OLTP)	1987	3,323
➢ Stretch Power Uprate (104.3% OLTP)	1995	3,467
➢ Option III Stability Solution	2000	3,467
➢ Renewed Operating License	2006	3,467
➢ MELLLA Operating Domain	2008	3,467
➢ Extended Power Uprate (120% OLTP) (Current Licensed Thermal Power - CLTP)	2012	3,988

MELLLA+ Project Overview

Dale Goodney

MELLLA+ Licensing

- MELLLA+ License Amendment Request includes:
  - Expanded operating domain
  - DSS-CD thermal-hydraulic stability solution
  - Increase Safety Limit Minimum Critical Power Ratio (SLMCPR)
  - Associated Technical Specification changes

- No other pending license applications related to NMP2 MELLLA+ project

MELLLA+ Licensing Timeline

Key Milestones	Date
➢ Pre-Application Meetings	February/March 2013
➢ MELLLA+ License Amendment Request (LAR) Submittal	November 2013
➢ NRC Acceptance Review	January 2014
➢ MELLLA+ LAR Fuels Supplement	February 2014
➢ MELLLA+ LAR Revision 01	June 2014
➢ NMP2 ATWS Simulator Audit	November 2014
➢ Draft NRC MELLLA+ Safety Evaluation Report	May 2015
➢ ACRS Subcommittee	June 2015
➢ ACRS Full Committee	July 2015 (planned)
➢ Receive MELLLA+ LA	August 2015 (planned)
➢ Implement MELLLA+ LA	September 2015 (planned)

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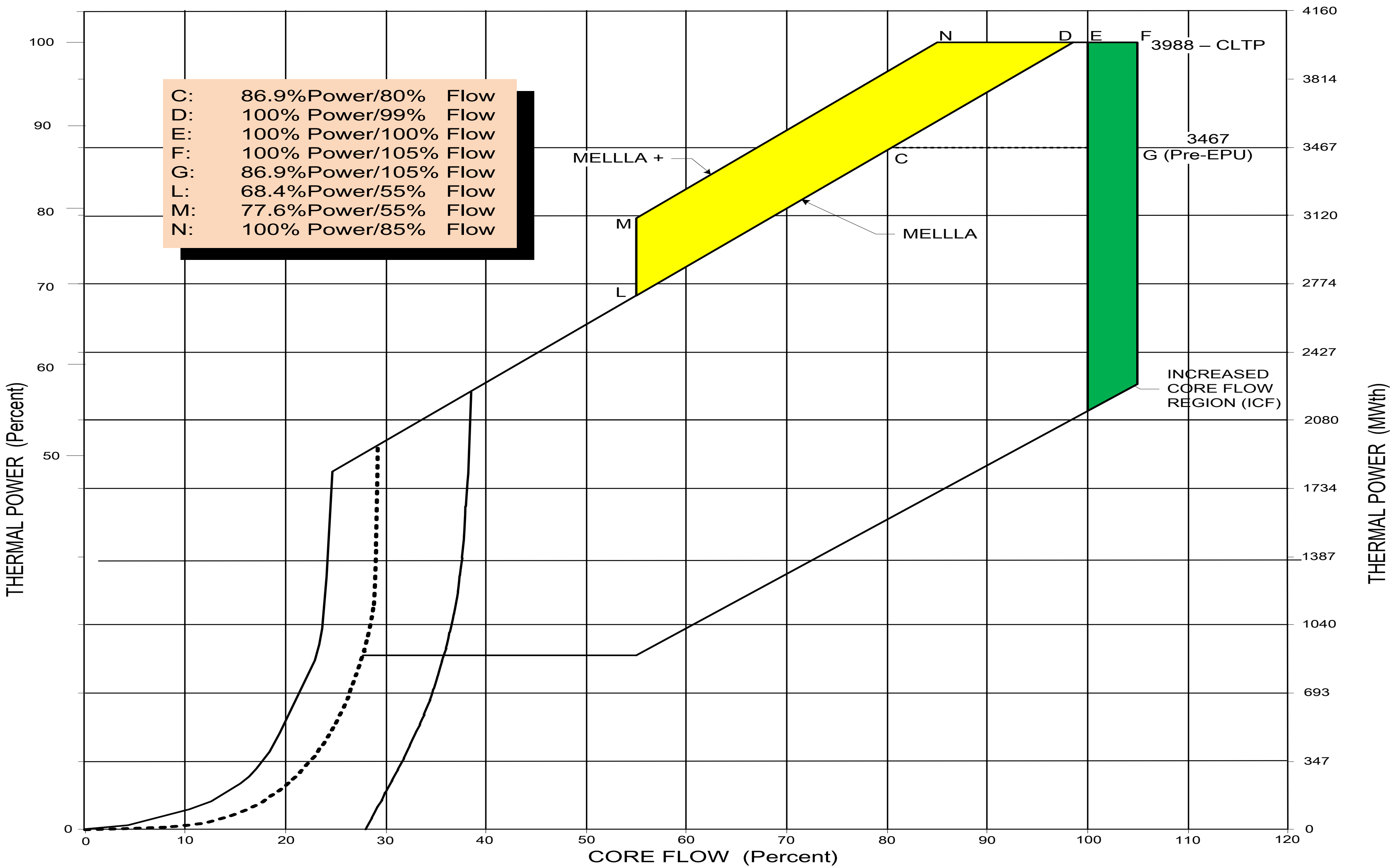
MELLLA+ Benefits

- Expands core flow window at 100% power by ~14% of rated flow
  - Provides greater operational flexibility
  - Eliminates control rod manipulations to compensate for reactivity changes and maintain 100% power
  - Fewer End of Cycle deep down powers for rod pattern adjustments

MELLLA+ Benefits - Power/Flow Map



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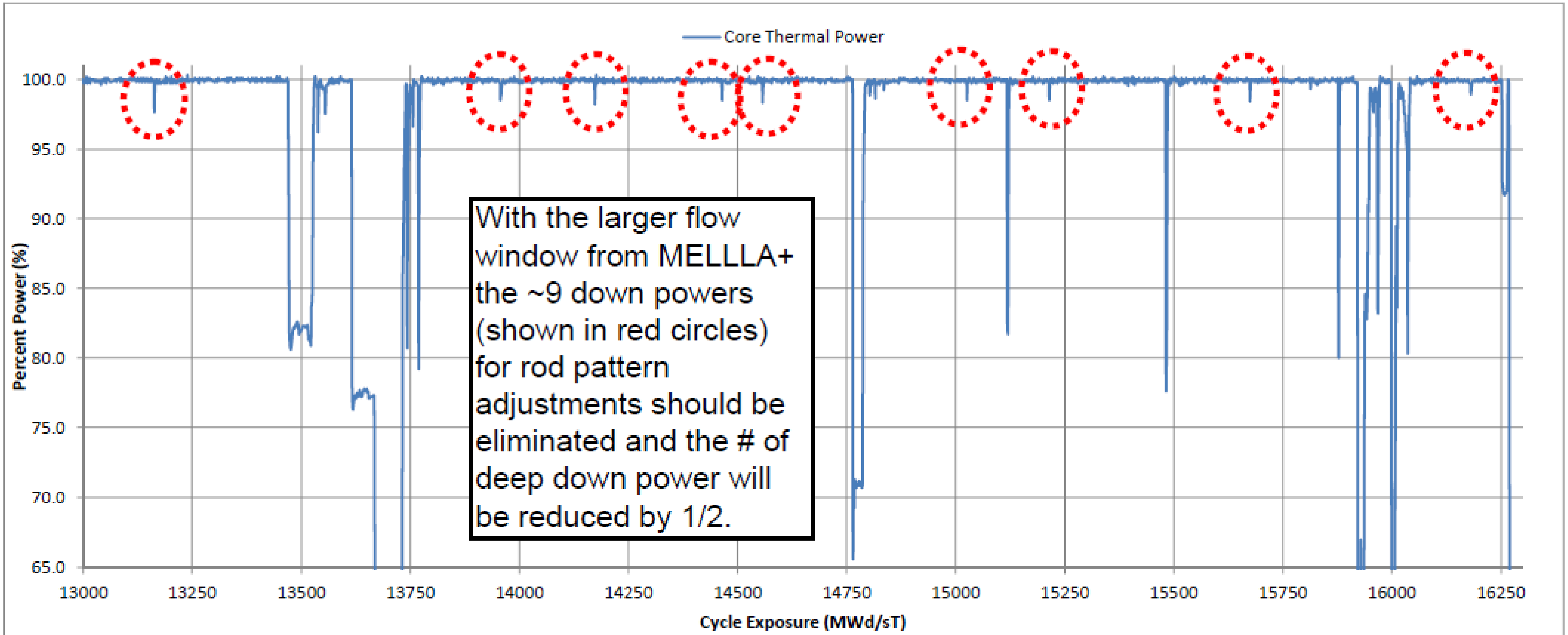
MELLLA+ Benefits

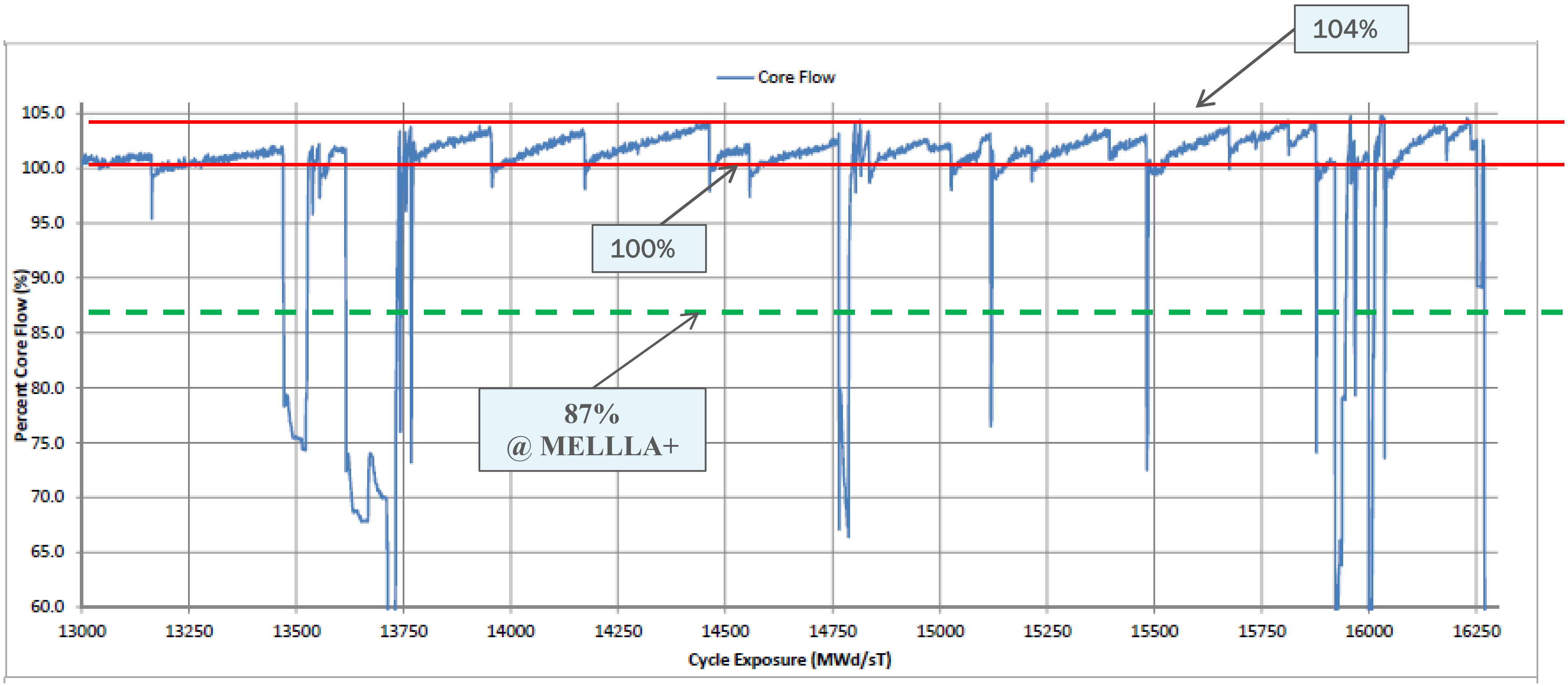
Near End of Cycle Down Powers – First Extended Power Uprate (EPU)/MELLLA Operating Cycle



- Actual data for last 4 months of operating cycle
- Small down powers (to 98% CLTP) will be eliminated
- Rod withdrawal deep down powers (65% to 80% CLTP) will be reduced by 50%

MELLLA+ Benefits

Near End of Cycle Core Flow – First EPU/MELLLA Operating Cycle



- Minimum operating core flow will be ~87% to maintain 2% margin to the MELLLA+ rod line

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MELLLA+ Project Scope

- **MELLLA+ does not change:**
  - Operating Pressure
  - Maximum Licensed Thermal Power
  - Maximum Licensed Core Flow
  - Feedwater Flow Rate or Temperature

- MELLLA+ does not require modifications to balance of plant equipment

Exelon Generation.

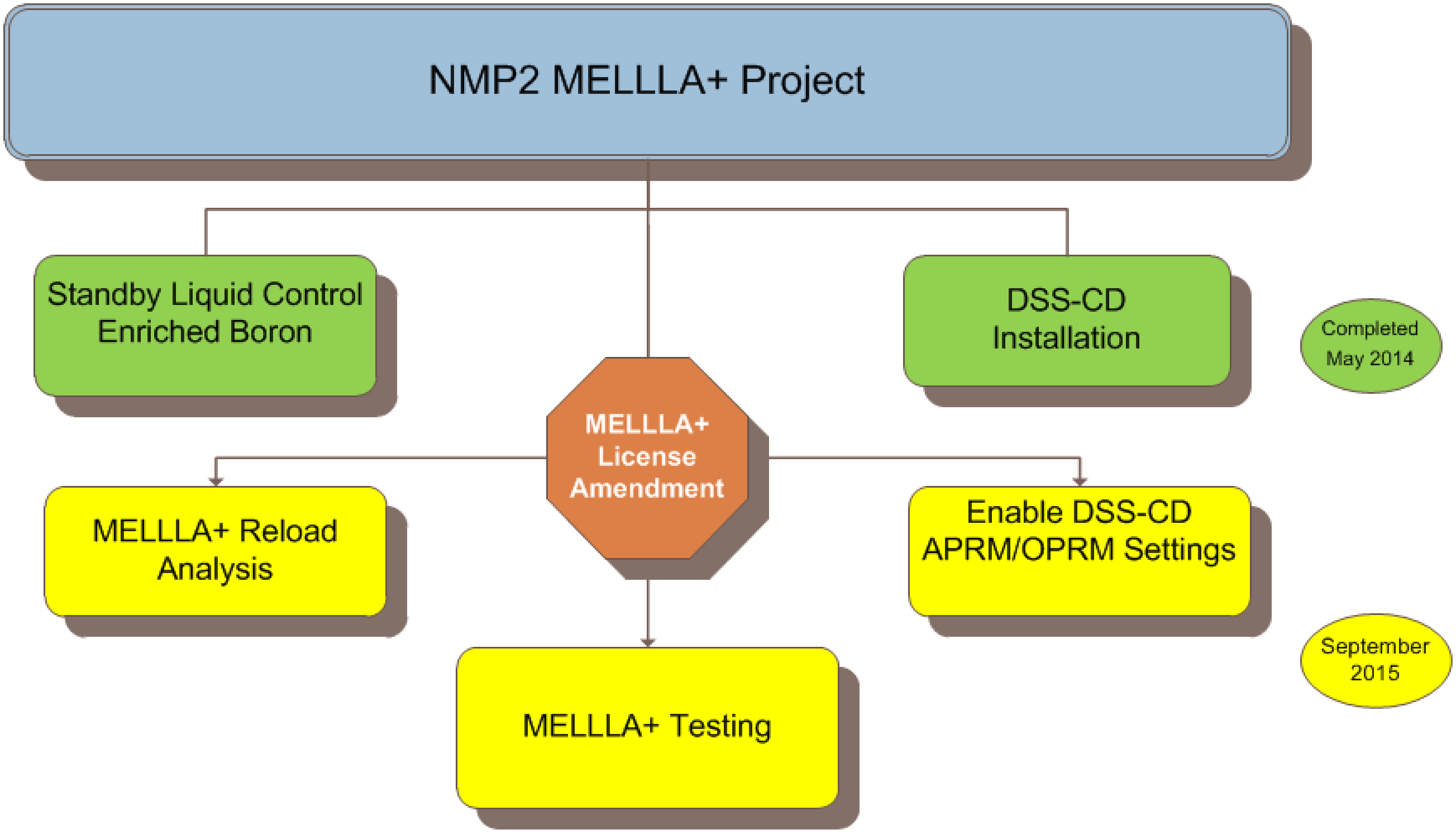
MELLLA+ Project Scope

- MELLLA+ project scope includes:
  - Revised Power/Flow Map
  - DSS-CD stability solution and associated Oscillation Power Range Monitor (OPRM) settings
  - Standby Liquid Control System margin improvement
  - New APRM settings
  - MELLLA+ Reload Analysis

MELLLA+ Implementation

- Installation and test activities are governed by the station design change and work control processes
- Implementation will occur on-line within 90 days after MELLLA+ License Amendment approval
- MELLLA+ implementation is in two phases:
  - 2014 - Outage-related plant modifications (Complete)
  - 2015 (September) - On-line installation/TS implementation/Testing

MELLLA+ Implementation



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Enable DSS-CD

- **Remove CDA Bypass Jumpers**
  - One APRM logic module at a time:

    Enter LCO

    RPS test device installed to prevent ½ scrams

    Remove physical jumper (2 per APRM channel)

    Perform Channel Functional Test

    Exit LCO

- **OPRM Setting Changes**
  - Bypass one APRM channel at a time
  - Install settings and test Channel 1 and 3 OPRM (Inop, enter LCO))
  - Implement TS (Channel 2 and 4 Inop)
  - Install settings and test Channel 2 and 4 OPRM (Exit LCO)

MELLLA+ Design and Analyses

George Inch

Exelon Generation.

NMP2 MELLLA+ Design and Analysis Overview

- Key Features of the NMP2 MELLLA+ LAR:
  - Design and Analysis credits Boron-10 92 atom % to maintain margin to (HCTL High Containment Temperature Limit) as per MELLLA+ LTR L&C 12.18b.
    - Improves Margin to HCTL compared to Stretch and EPU conditions by reducing impact on suppression pool temperature
    - Increases Standby Liquid system pump redundancy
  - Design and Analysis credit NMP2 Redundant Reactivity Control System (RRCS) design attributes for automatic injection of Standby Liquid control System (SLS) and automatic feedwater flow runback
    - Minimizes operator action response time requirements to mitigate ATWS for MELLLA+

Exelon Generation.

NMP2 MELLLA+ Design and Analysis Overview

- NMP2 EPU Core Flow Operating Margins
- NMP2 EPU Moisture Carryover (MCO) Operating Experience
- NMP2 MELLLA+ MCO Assessment
- DSS-CD
- MELLLA+ SRLR
- NMP2 RRCS design and Operator Actions for ATWS
- ATWS ODYN Licensing Basis Analysis
- NMP2 Standby Liquid Control System Margin Improvement
- MELLLA+ Implementation Test Plan
- Monticello MELLLA+ Operating Experience

- ATWS ODYN Licensing Basis Analysis (with Supplement Proprietary information)
- ATWS with Core Instability TTWBP and Dual Recirculation pump trip (Proprietary Information)

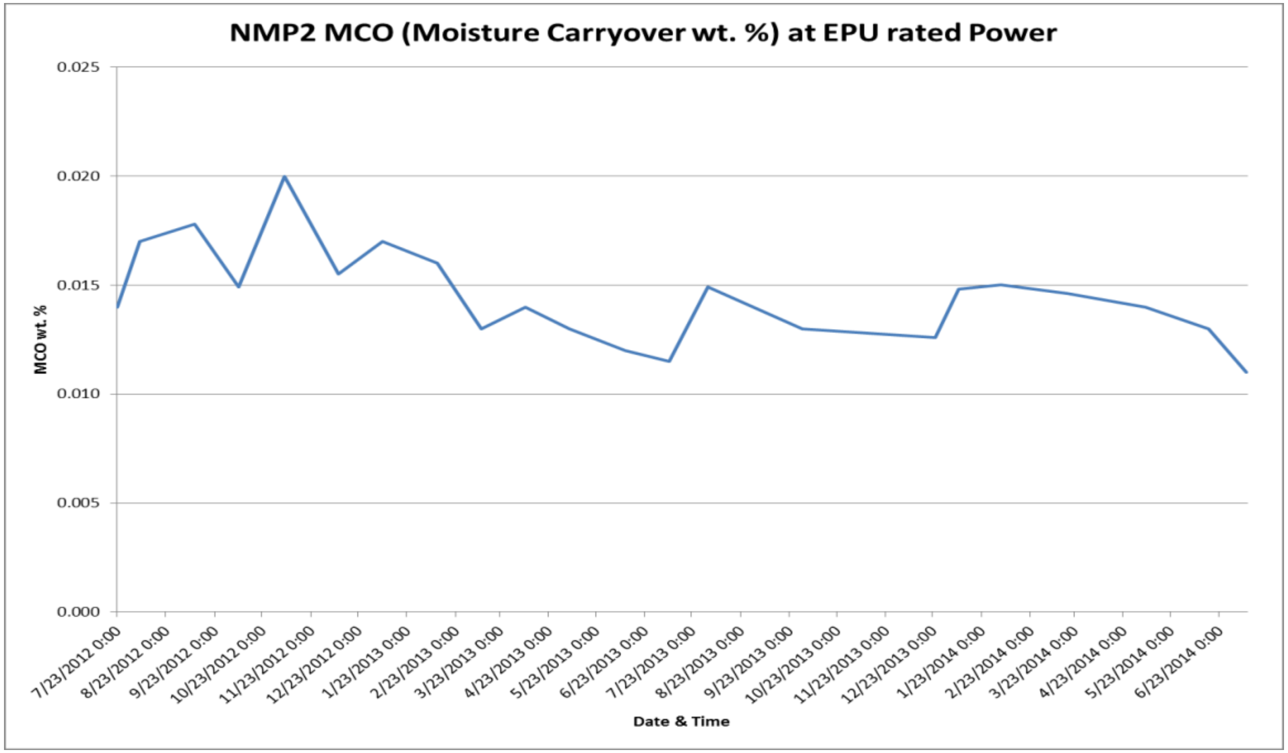
NMP2 EPU Core Flow Operating Margin

M+ objective is to recover the pre-EPU 20% core flow operating margin which includes the increased core flow region (100% to 105%)

- To operate at EPU power the MELLLA boundary requires core flow greater than 99% rated
- For EPU NMP2 installed anti-fouling JP mixers to restore original JP performance to achieve the maximum design rated JP performance capability at EPU of 103.9% core flow capability
  - The maximum rated core flow achieved at max flow control valve (FCV) position for the limiting core exposure cycle power shape is between 103 to 103.5%
  - 105% core flow achievable at End-of-Cycle (EOC) conditions and during Beginning-of-Cycle (BOC) conditions
  - The practical core flow operating window at EPU rated conditions is from 100% to 102.5%.
    - Operational margin to the MELLLA boundary at 99%
    - Maximum FCV position only used at EOC conditions

NMP2 EPU MCO Operating Experience

- Actual EPU operating Main Steam Moisture Carryover (MCO) remained essentially unchanged from Pre-EPU power level measured MCO
  - Average EPU MCO is well below predictions
  - NMP2 EPU core design results in flat radial peaking which equalizes steam separator loading. The EPU/MELLLA+ transition core has similar characteristics



MELLLA+ MCO Assessment

- MELLLA+ can impact MCO depending on MELLLA+ limiting operating conditions.
- MCO above the functional design performance specification of 0.1 wt% is predicted
  - Anticipated to occur less than 5% of the time based on equilibrium core projections
  - The maximum calculated MCO for MELLLA+ was 0.236 wt% for a limiting radial peaking rod pattern versus EPU predicted maximum of 0.125 wt% for a limiting radial peaking rod pattern for the M+ fuel cycle
- Radiological impact analyzed for MCO increase up to 0.35 wt%
- Flow Accelerated Corrosion (FAC) CHECWORKSTM model for EPU assumes steady-state MCO of 0.25 wt% Therefore, the FAC evaluation performed for EPU remains bounding for MELLLA+
- The limiting components are the MSIV's which restrict the maximum MCO to less than 0.25 wt%.
- MELLLA+ implementation includes monitoring the MCO at multiple points in the MELLLA+ region.

Long-Term Stability Solution (DSS-CD)

- The DSS-CD solution is designed to identify the power oscillation upon inception and initiate control rod insertion to terminate the oscillations prior to any significant amplitude growth.
- DSS-CD will replace currently licensed Option III using PRNMS – OPRM
  - The existing Option III algorithms are retained to provide defense-in-depth protection for unanticipated reactor instability events.
- Confirmation Density Algorithm (CDA) protects SLMCPR in the entire licensed power/flow map, including MELLLA+ conditions
- DSS-CD analysis for NMP2 performed in accordance with the approved DSS-CD LTR, with no deviations
- NMP2 has upgraded PRNMS hardware to include DSS-CD for M+
  - When OPRM system is inoperable ABSP will be utilized
  - When both OPRM and ABSP are inoperable Manual BSP will be utilized
  - When manual BSP cannot be implemented reduce power to < 18% RTP

Experience

- 15 years with Option III on PRNMS hardware
- > 1 year of operating history with PRNMS using DSS-CD in background

MELLLA+ SRLR

MELLLA+ Supplemental Reload Licensing Report (SRLR) submitted to NRC February 25, 2014 as supplemental information to MELLLA+ Licensing Amendment Request

- Reload analysis based on currently operating C15 core design.
- Minor thermal limit increase reflects SLMCPR adder for Two Loop Operation (TLO) and small changes to limiting transients for MELLLA+
- Two Loop Operation Safety Limit increases from 1.07 to 1.09
- No impact on Linear Heat Generation Rate (LHGR), Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) limits

Licensing Basis	LTR SER L&C	EPU Cycle 14 SLMCPR Adder	MELLLA+ Cycle 15 SLMCPR Adder
EPU / MELLLA (PUSAR)	9.4 (Methods)	0.02	0.00
Off-Rated CF Uncertainty	12.6 (M+)	N/A	0.03
EPU / MELLLA+ with >42 MWt/Mlbm/hr	9.5 (Methods)	N/A	0.02

Adders assumed at the start of Cycle14 based on NEDC-33173P-A Revision 3,

Start of Cycle15 based on NEDC-33173P-A Revision 4.

- NMP2 Power Density
- @ EPU 3988 MWt 58.99 kW/l, 43.3 MWt/Mlbm/hr Maximum P/F at point M = 51.86 MWt/Mlbm/hr

NMP2 Redundant Reactivity Control System

The NMP2 Redundant Reactivity Control System (RRCS) system includes two important Automatic features important for ATWS with Core Instability (ATWS-I) considerations:

- Automatic SLS pump start on Hi reactor pressure (1095 psig, T.S. ≤ 1080 psig, nominal 1065 psig) with APRMs not downscale (>4%)
  - Nominal delay setting 98 seconds (RRCS has digital timers with minimal setpoint drift)
  - Analysis assumes 120 second initiation delay

- Automatic feedwater runback on Hi reactor pressure 1095 psig, T.S. ≤ 1080 psig, nominal 1065 psig) with APRMs not downscale (>4%)

  - Nominal delay setting 25 seconds
  - Analysis assumes 33 second initiation delay
  - Runback from 100% to 0% in 21 seconds and automatically open FW pump minimum flow.

Operator actions required for Dual Recirculation pump trip where Hi reactor pressure is not reached

- Assumes Operator action to initiate a manual scram within 20 seconds
- Assumes Operator action within 270 seconds to initiate FW runback

Licensing Basis ODYN ATWS Analysis

- NMP2 has automatic SLS injection and automatic feedwater runback features credited in the licensing basis ATWS analysis for EPU and MELLLA+
- The limiting event for reactor peak pressure is the PRFO event. Peak pressure and PCT essentially unchanged from EPU/ MELLLA
- The Peak upper shroud plenum pressure (SLS pump discharge) is essentially unchanged from EPU/MELLLA because the pressure is largely a function of SRV setpoint pressure which is unchanged.
- Time to Hot shutdown reduced compared to EPU/MELLLA

Standby Liquid Control System Margin Improvement

Enriched boron-10 significantly improves operator margin for managing HCTL and reactor depressurization.

- MELLLA+SER Limitation and condition requires best estimate TRACG ATWS Analysis because hot shutdown is not reached prior to reaching HCTL
- MELLLA+ SER Limitation and Condition 12.18.b allows elimination of best estimate TRACG ATWS analysis based on the use of enriched boron-10 to reduce the integrated heat load to the containment such that it does not change with respect to the licensing ODYN reference OLTP/75 percent flow.
  - Peak Suppression pool reduced from EPU/MELLLA and remains essentially unchanged from OLTP/ 75 percent flow
  - Peak containment pressure reduced from 7.0 psig (EPU) to 6.5 psig. The design limit is 45 psig

Note: With normal suppression pool level and initial temperatures realistic simulator scenarios show hot shutdown achieved prior to reaching HCTL.

Standby Liquid Control System Margin Improvement

- With the Boron-10 92 atom %, NMP2 can meet the boron equivalent control capacity requirement of 10 CFR 50.62(c)(4) by utilizing the flow rate of a single SLS pump.

- Entering the flow rate for a single SLS pump (40 gpm) into the applicable equation from the NRC-approved licensing topical report NEDE-31096P-A yields 2.26, demonstrating that a single pump meets the equivalent control capacity requirement.

- Supplemental analyses for all NMP2 licensing basis transients based on single SLS pump flow rate demonstrates NMP2 meets all ATWS licensing basis criteria.

MELLLA+ Implementation Test Matrix

Test Condition (TC) →	TC 1	TC 2	TC 3	TC 4	TC 5	TC 6	TC 7	TC 8	TC 9	TC 10	TC 11	TC 12
Description	Point D	2% (P & F) Offset from Point D	Point L	Point (L+M)/2	Point M	90% Pre-EPU	95% Pre-EPU	100% Pre-EPU	105% Pre-EPU	110% Pre-EPU	2% Power Offset from Point N	Point N
Power (MWth)	3988.0	3908.2	2727.8	2911.2	3094.7	3120.3	3293.7	3467.0	3640.4	3813.7	3908.2	3988.0
Power (%)	100.0	98.0	68.4	73.0	77.6	78.2	82.6	86.9	91.3	95.6	98.0	100.0
Flow (%)	99.0	97.0	55.0	55.0	55.0	55.8	61.7	67.5	73.3	79.1	82.3	85.0
Rod Line (%)	100.66	99.99	100.69	107.46	114.23	114.10	113.16	112.44	111.91	111.54	111.39	111.30
Test 1B - Steam Dryer/Separator Performance	X		X		X			X		X		X
Test 19 - Core Performance	X		X	X	X			X		X		X
Test 22 - Pressure Regulator (Recirc. System in MANUAL)		X	X		X			X			X	
Test 23A - Water level Setpoint Change (Recirc. System in MANUAL)		X	X		X			X			X	
Test 99A - Neutron Flux Noise Surveillance			X		X							X
Test 99B - TIP Power Distribution												X
Test 99C - Stability Monitor Performance	X		X		X			X				X
Test 101 - Plant Parameter Monitoring & Evaluation (includes Rad Monitoring)	X		X		X			X		X		X

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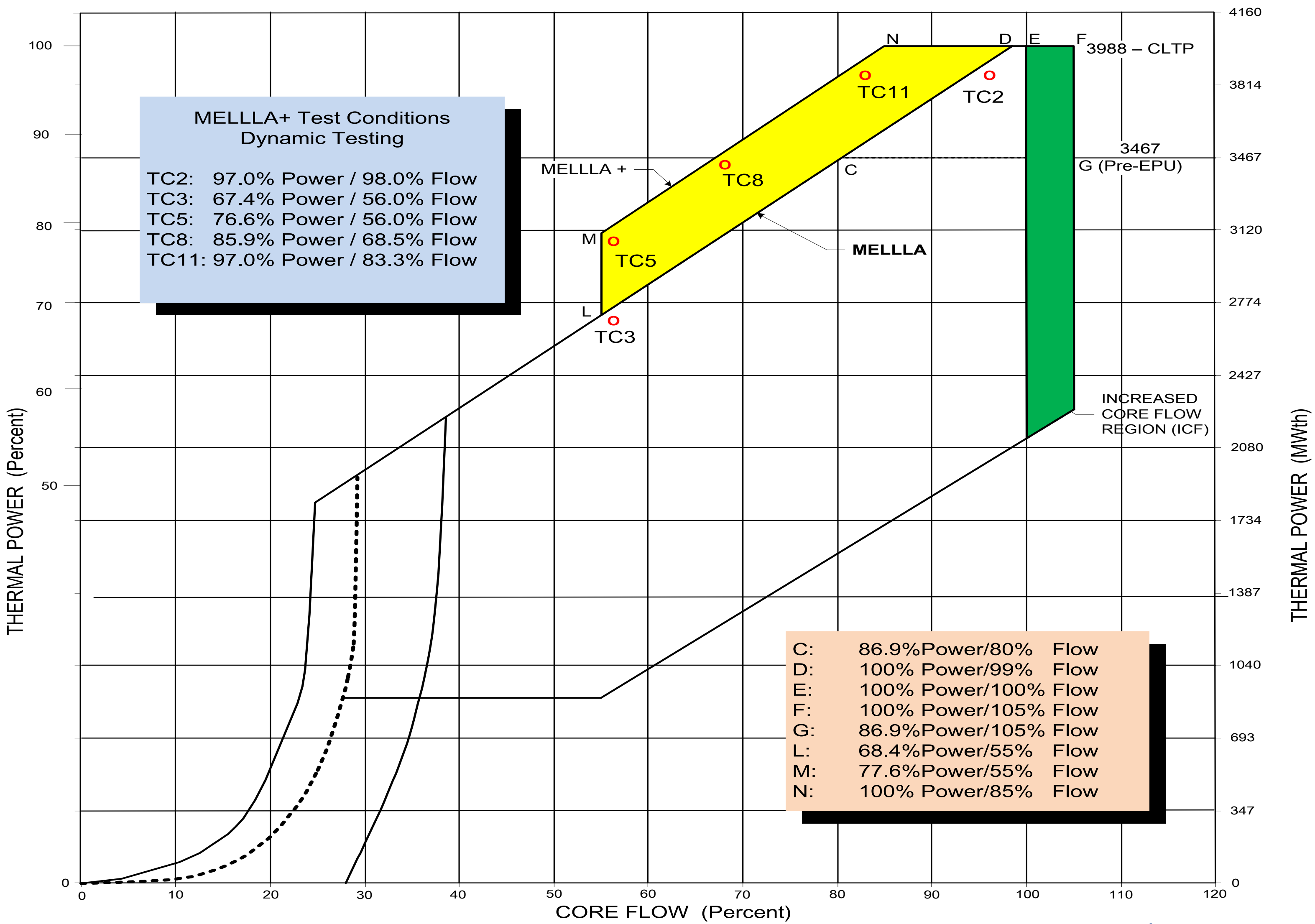
MELLLA+ Dynamic Test Conditions



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MELLLA+ Operating Experience

- Monticello MELLLA+ OPEX identified unexpected MSL high radiation alarm associated with MELLLA+
  - Increases in main steam line dose rates related to reactor coolant hydrogen increases at rated power with reduced core flow are expected
  - Operating at hydrogen injection rates near or above a threshold level can result in higher MSL dose increases than experienced pre EPU
- NMP2 uses Online Noble Metals and has implemented post EPU hydrogen ramp testing to optimize the hydrogen injection rate to maintain the 4:1 Boiling Water Reactor Vessel Integrity Program (BWRVIP) recommended ratio for the upper core shroud location
  - Optimized hydrogen injection has resulted in reduced main steam radiation below the threshold level
  - MELLLA+ related change in main steam radiation levels anticipated to remain below the alarm setpoint.
  - Monitoring of MSL radiation levels will confirm expected response

MELLLA+ Operator Procedures and Training

Dan Cifonelli

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Technical Specification Changes Summary

1. TS 2.1.1: MCPR Safety Limit from ≥ 1.07 to ≥ 1.09 for Two Loop Operation
2. TS 3.1.7: Increased SLS Pump required Discharge Pressure from 1327psig to 1335 psig. [B-10 enrichment from ≥ 25 atom% to ≥ 92 atom% (note no reduction in concentration, 13.6 wt% to 14.4 wt% remains) License Amendment No. 143, approved March 14, 2014]
3. TS 3.3.1.1: RPS OPRM Scram changed from Option III to DSS-CD Solution
4. TS 3.3.1.1: RPS APRM STP Trip changed from ≤ 0.55W+60.5% and ≤ 115.5% to ≤ 0.61W+63.4% and ≤ 115.5%
5. TS 3.3.1.1: RPS OPRM Inoperable Actions added ABSP and Manual BSP
6. TS 3.4.1: Single Loop Operation prohibited in MELLLA/MELLLA+ domain
7. TS 5.6.5: Require COLR to include cycle specific Region I and Region II, ABSP Region and BSP Boundary
8. TS 5.6.8: 90 day reporting requirement for OPRM Inoperability

Normal OPRM Operable P/F Map MELLLA+ with DSS-CD

MELLLA+ P/F Maps were developed considering Operator experience, human factors and conservatism to manage change and assure operator success. Draft P/F Maps introduced to all Licensed Operators early (August 2014) in a training setting to solicit feedback, several specific improvements were incorporated.

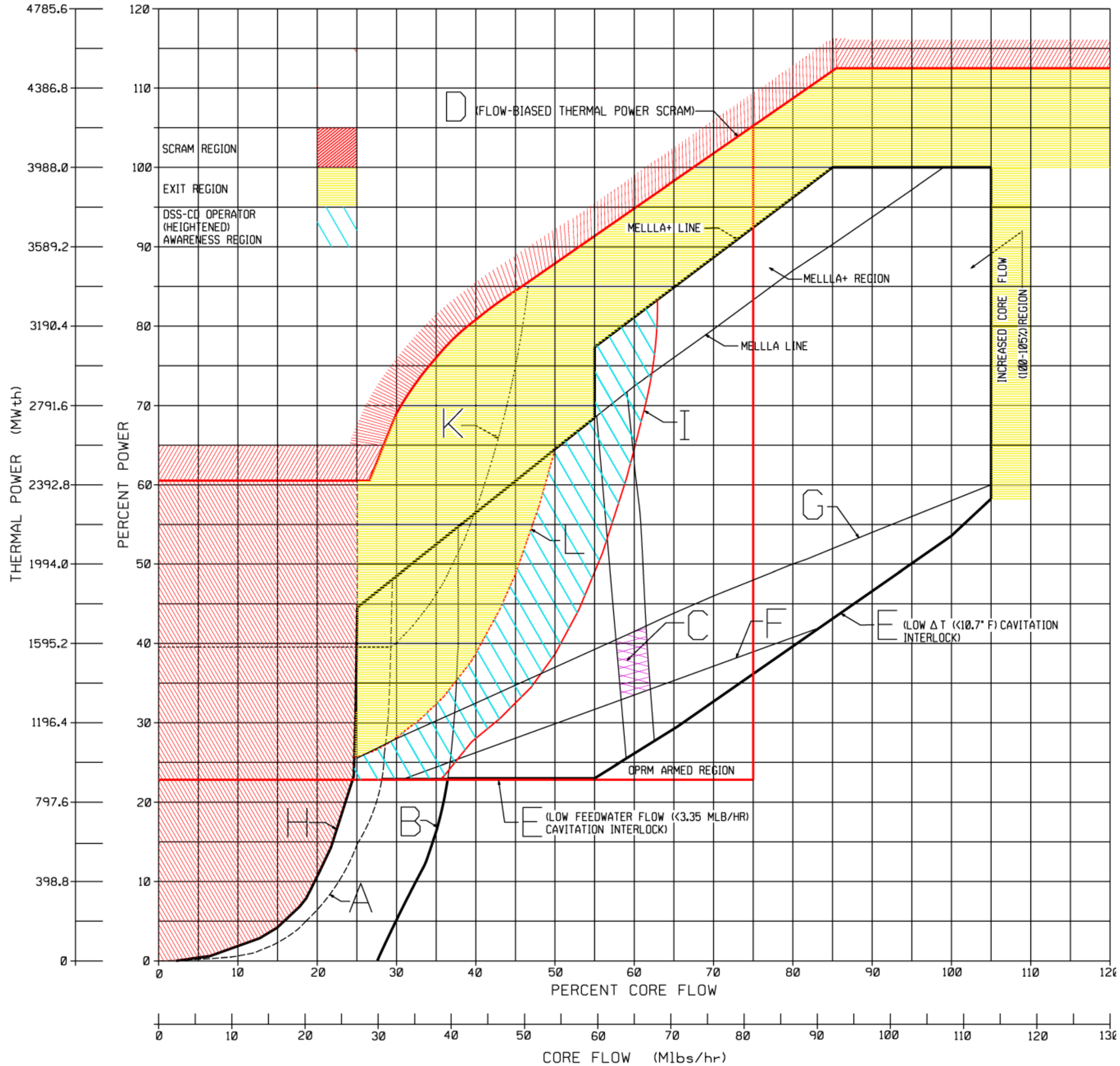
Maintained Operator familiar terminology such as “Exit Region”

Maintained similarity in visual clues (color coding, line designations, etc.)

Eliminated irrelevant information where possible

Clarified notations

Created additional maps for condition if OPRMs were to become INOPERABLE



Use of P/F Map for Back-up Stability Protection

P/F Maps with Operating Procedures will be used to implement Technical Specifications required (COLR verified) ABSP and Manual BSP.

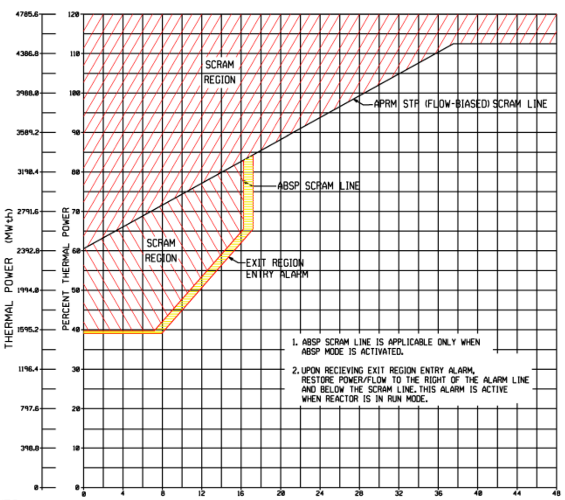
Automatic Backup Stability Protection drive flow figure

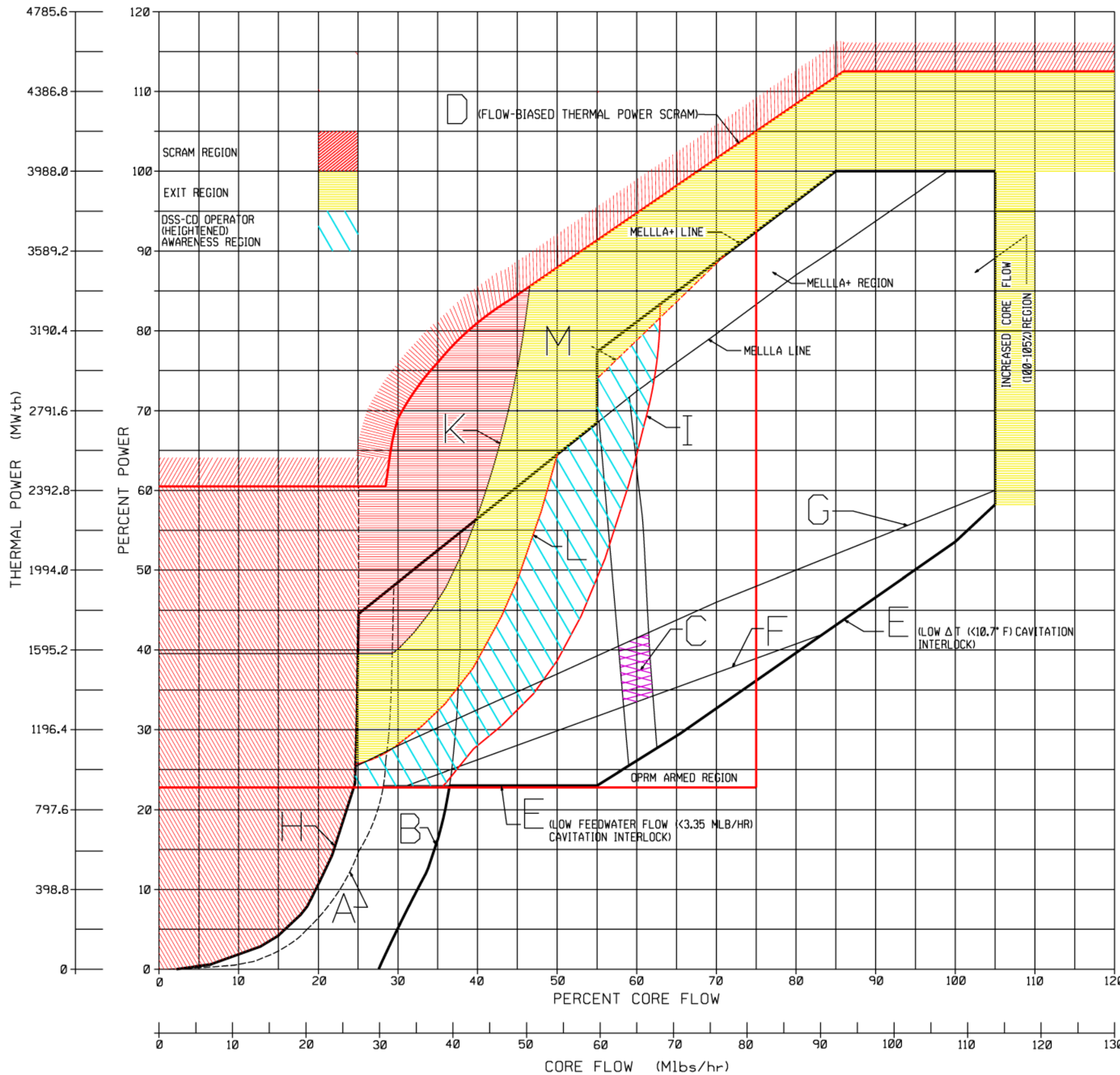
Manual BSP Scram Region (Region I) Line K (app same as ABSP)

Manual BSP Controlled Entry Region (Region II) Line L

BSP Boundary Line M

Operator (Heightened) Awareness Region Line I





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Operator Procedures

- NMP2 Emergency Operating Procedures ATWS mitigation contingency has included the strategy of lowering reactor vessel water level to below the feedwater sparger to mitigate thermal hydraulic oscillations since circa 1998 with implementation of Emergency Procedure Guidelines/Severe Accident Guidelines EPG/SAG Rev 1.

- With OPRMs OPERABLE, normal, abnormal and transient Operator Actions are unchanged but the regions on the P/F map where they are implemented have changed.

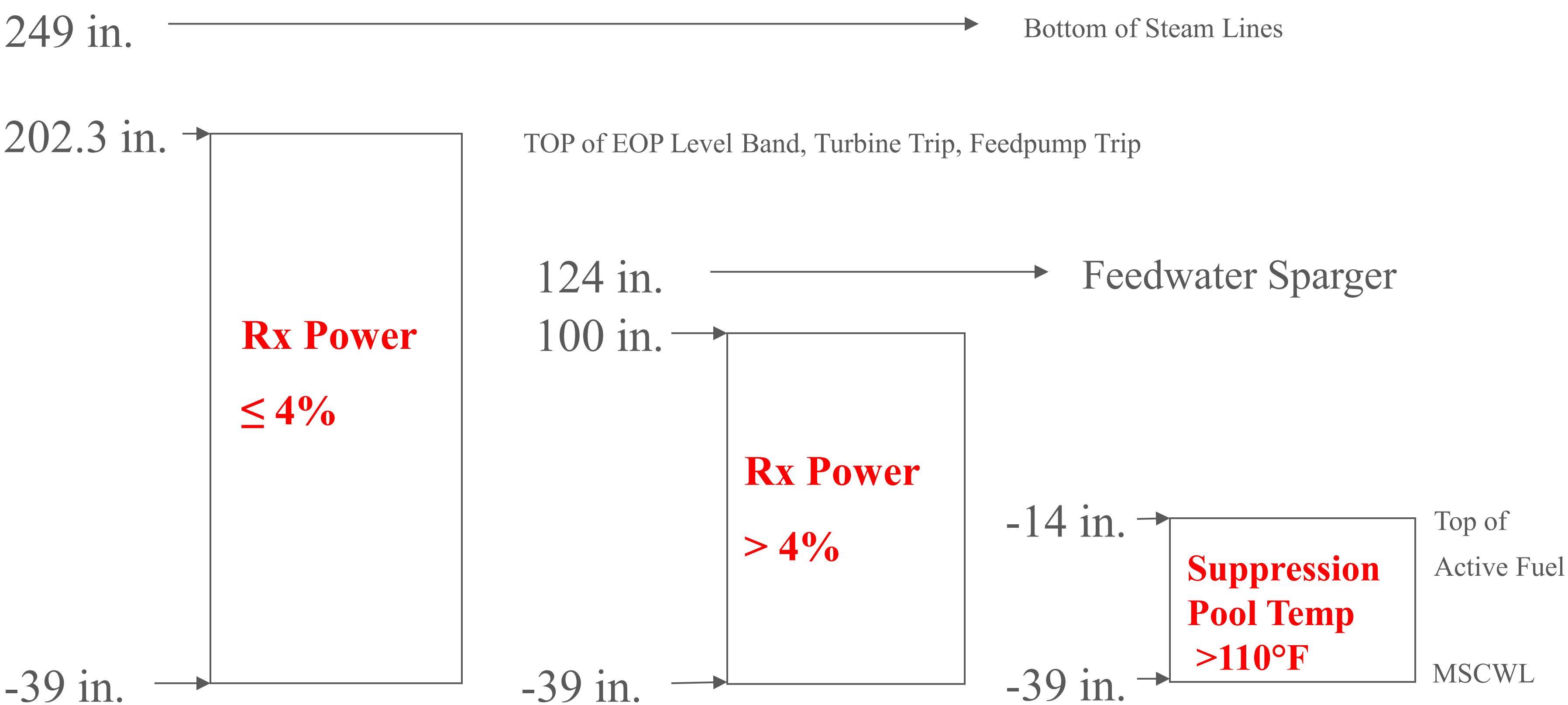
- With OPRMs INOPERABLE, Operator Actions are governed by Technical Specifications (and COLR) and implemented by Operating Procedures and the P/F Map).

- Procedure changes required for MELLLA+ implementation have been prepared.

EOP-C5 Level Control

- The Senior Reactor Operator (SRO) works thru C5 and directs the Reactor Operator (RO) to Terminate and Prevent Injection. The RO Repeats back order. SRO closes the three way communication.

- The scripted order is "Terminate and Prevent injection, when level drops to less than 100 inches, make your level band 50 to 80 inches".



Time Critical Operator Actions & Validation

Two ATWS-I Mitigating Strategy Operator Actions have been re-classified as Time Critical Operator Actions.

1. 20 seconds insert a Manual Scram using the Mode Switch
   - Provides additional Scram signal and bypasses the low pressure MSIV Isolation

2. 270 seconds to Terminate and Prevent injection in a dual Recirc Pump Trip
   - Step L-9 in N2-EOP-C5, Mitigates power oscillations to a PCT of 912°F

These actions times were validated in September 2014 per OP-AA-102-106, Operator Response Time Program.

1. A validation team including Engineers, Qualified Simulator and Operations Instructor, Shift Manager, and four active on-shift operating crews during a 5-week training cycle
2. The crews performed each action (Scram, Terminate and Prevent Injection into the Reactor Vessel (T/P)) while controlled by Qualified Instructor and Observed by Validation Team Members (time data captured by simulator computer and observers using watches)
3. Five scenarios were used for Scram data, one (Dual Recirc Pump Trip) used for T/P data gathering
4. Validation included minimum staffing review to test sensitivity of time to reduced staff. Reduced staffing had no measurable impact on times due to procedural priority, operator knowledge/proficiency, simplicity of tasks and action performance requires one operator.

Time Critical Operator Actions & Validation Results

Validation Results

1. Time Action 1: 5 to 16 seconds with an average of 8.5 seconds
   - Average Time is 43% of Required Time (20 seconds)

2. Time Action 2: 150 to 232 seconds with an average of 193 seconds
   - Average Time was 71.5% of Required Time (270 seconds)

3. Required recognition instrumentation, controls manipulated and operator actions can be performed in front panels of the Control Room by a single operator.

4. Actions are controlled by formal procedures.

5. Demonstrated times have significant margin to required times, which account for uncertainties, stress, event recognition, action planning, team communication and verification practices.

6. Validation reports were submitted to the NRC post Simulator Audit.

Actions are consistent with current Operator training, knowledge and proficiency. No procedure changes or training changes are needed to assure actions are met. The importance of timely reduction of reactor vessel water level to below the feedwater sparger to reduce subcooling and mitigate oscillations in an ATWS, has been and is reinforced during Licensed Operator training.

Time Critical Operator Actions Maintenance

- Actions are maintained by Design and Operations per OP-AA-102-106, Operator Response Time Program and OP-NM-102-106, Operator Response Time Program at Nine Mile Point.

- Engineering is responsible for identifying and resolving potential design changes that could impact Time Critical Operator Actions.

- Operations is responsible for identifying and resolving potential procedure changes that could impact Time Critical Operator Actions.

- Operations with the assistance of Operations Training is responsible for re-validation of Time Critical Operator Actions every 5 years.

Operator Training

- **June 2014 Initial Classroom Training**
  1. Introduction to MELLLA+
  2. DSS-CD algorithm overview
  3. Proposed Changes to the Technical Specifications

- **August 2014 Initial Simulator Training**
  1. Proposed Power to Flow Map (actively solicited Operator feedback)
  2. Demonstration of impact of 92% atom-enriched Boron-10
  3. Time Critical Operator Actions Review and practice
  4. Five ATWS scenarios at 100% power, 85% flow (Maximum MELLLA+ Conditions)

     (Simulator was validated to MELLLA+ TRACG Model prior to training)
     1. Dual Recirc Pump Trip ATWS
     2. LOOP ATWS
     3. MSIV Closure ATWS
     4. Turbine Trip without Bypass ATWS
     5. PRF ATWS

Operator Training

- **January 2015 Classroom Reinforcement**
  1. Power to Flow Map
  2. New Abnormal Procedures changes
  3. Technical Specification scenarios (what would you do if)

- **May 2015 Reviewed Industry Instability Operating Experience**
  1. Emphasis on inserting Control Rods
  2. Emphasis on impact of sub-cooling changes to core stability
  3. Emphasis on recognition of oscillations and Operator Action if detected (i.e. Scram)

- **(Scheduled) July 2015 Simulator**
  1. Overview of implementation and testing program (Specific Crews will receive additional Just In-Time Training (JITT))

End of Open Session

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