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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 UPRATE SUBCOMMITTEE

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WEDNESDAY

MAY 16, 2018

+ + + + +

OPEN SESSION

+ + + + +

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 L.
Rempe, Chairwoman, presiding.

COMMITTEE MEMBERS:

JOY L. REMPE, Chairwoman

RONALD G. BALLINGER, Member

MICHAEL L. CORRADINI, Member

WALTER L. KIRCHNER, Member

JOSE A. MARCH-LEUBA, Member

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PETER C. RICCARDELLA, Member
GORDON R. SKILLMAN, Member

DESIGNATED FEDERAL OFFICIAL:

WEIDONG WANG

ALSO PRESENT:

JOSH BORROMEO, NRR
RALPH GRUMMER, Framatome
DAVID MCBURNEY, Framatome*
AHSAN SALLMAN, NRR
ROBERT SCHAPP, Framatome*
ASHLEY S. SMITH, NRR*
DAN TINKLER, Framatome*
AARON WYSOCKI, ORNL
STEPHEN YODERSMITH, Duke

*Present via telephone

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

8:29 a.m.

CHAIRWOMAN REMPE: This meeting will now come to order.

This is a meeting of the Power Uprate Subcommittee, a Standing Subcommittee of the ACRS.

And, I'm Joy Rempe and I Chair this Subcommittee.

ACRS members in attendance include Ron Ballinger, Dick Skillman, Mike Corradini, Pete Riccardella, Jose March-Leuba and Walt Kirchner.

Weidong Wang is the -- of the ACRS staff is the Designated Federal Official for the this meeting.

In this meeting, the Subcommittee will review the safety evaluation for the Brunswick Steam Electric Plant Units 1 and 2 Operating License Amendment Request to allow plant operation in the expanded maximum extended load line limited analysis plus or MELLLA+ domain.

As you may recall, this is the fifth plant to submit an LAR for operation in the MELLLA+ domain, but the first to rely on GEH methods with Framatome, formerly AREVA, ATRIUM 10XM fuel.

And, in this meeting, we'll hear

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1 presentations from the NRC staff and representatives
2 from the licensee, Duke Energy Progress, Incorporated.

3 We did not receive written comments or
4 requests for time to make oral statements from any
5 member of the public regarding today's meeting.

6 Part of the presentations by the licensee
7 and the NRC staff will be closed in order to discuss
8 information that's proprietary to the licensee and its
9 contractors pursuant 5 USC 552(b)(c)(4).

10 Attendance at these portions of the
11 meetings that deals with such information will be
12 limited to the NRC staff and its consultants, Duke
13 Energy Progress, Incorporated and those individuals
14 and organizations who've entered into an appropriate
15 confidentiality agreement with them.

16 So, consequently, we'll need to confirm
17 that we only have eligible observers and participants
18 in the room for the closed portions of this meeting.
19 And, we're going to rely on the staff and Duke Energy
20 to assist us with this when we reach that point during
21 the meeting.

22 The Subcommittee today will gather
23 information, analyze relevant issues and facts and
24 formulate proposed positions and actions as
25 appropriate for deliberations by the Full Committee.

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1 The rules for participating in today's
2 meeting have been announced as part of the Notice of
3 this meeting previously published in the Federal
4 Register.

5 A transcript of the meeting is being kept
6 and will be made available in the Federal Register
7 Notice.

8 Therefore, we request that participants in
9 this meeting using the microphones located throughout
10 the meeting room when addressing the Subcommittee
11 meeting.

12 And, the participants should first
13 identify themselves and speak with sufficient clarity
14 and volume so that they may be readily heard.

15 I want to remind everyone, we start --
16 before we start to turn off your noisy little devices
17 and make sure that they don't interrupt us.

18 MEMBER KIRCHNER: Getting feedback from
19 somewhere.

20 CHAIRWOMAN REMPE: Weidong -- he's working
21 on it? Which actually means we need to --

22 (SIMULTANEOUS SPEAKING)

23 CHAIRWOMAN REMPE: Yes, we have to wait
24 until we have a minder, but I'm going to go ahead and
25 say that we're going to soon proceed with the meeting

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1 and, when we do start the meeting, Jose -- Weidong's
2 back. So, are you taking care of the noise? There's
3 some feedback up here.

4 MEMBER KIRCHNER: Someone may have their
5 phone on watching.

6 CHAIRWOMAN REMPE: Maybe --

7 MEMBER MARCH-LEUBA: You think it's the
8 phone line?

9 CHAIRWOMAN REMPE: Yes, why don't you
10 check and see and maybe Theron can help with that.

11 But, when we do start the meeting, I'm
12 going to call on Gregory Suber to start. Okay?

13 Okay, Gregory, go ahead and start.

14 MR. SUBER: Okay, thank you.

15 And, good morning. My name is Gregory
16 Suber and I am a Deputy Director in the Division of
17 Operating Reactor Licensing in the Office of Nuclear
18 Reactor Regulation.

19 It is my pleasure to introduce you to the
20 ACRS Subcommittee, the NRC staff who have been working
21 on the Brunswick MELLLA+ review.

22 So, we have presented a number of extended
23 power uprates for this Subcommittee. This is the
24 first application with the combination of GEH
25 methodology and Framatome fuel.

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1 The staff's presentation will highlight
2 this important methodology that increases operational
3 efficiencies, by reducing downpowers and control rod
4 manipulation.

5 During this review, the staff leveraged
6 precedents from previous reviews like Grand Gulf, Nine
7 Mile Point, Monticello and Peach Bottom.

8 Additionally, we have reached out to our
9 colleagues in the Office of Research who our user need
10 request to perform plant-specific independent studies
11 for ATWS events with the NRC's TRACE code and with the
12 latest costing thermal hydraulic test loop data.

13 Their assistance was instrumental in
14 completing this review and we'd like to express our
15 gratitude to Research for their participation.

16 As the staff's presentation will show,
17 special attention was paid to the interface between
18 the key elements and the first review with the GEH
19 methodology and Framatome fume -- fuel -- it's not
20 fume, it's fuel, sorry about that.

21 We have initiated a review of Browns Ferry
22 which utilizes a similar approach.

23 Thank you for your attention and I will
24 turn it over to Mr. Andy Hon.

25 MR. HON: Thank you, Gregory.

1 Good morning, Chairman Rempe and
2 distinguished members of ACRS. I'm Andy Hon. I'm the
3 Project Manager for the Brunswick MELLLA+ application
4 with NRR. And, I'm going to give a quick overview of
5 the project. My colleague, Josh, will be leading the
6 technical discussion later on in the closed session.

7 For Brunswick, the plant was approved for
8 EPU uprate in 2002 to allow them to operate at
9 additional 20 percent above the original license power
10 limit.

11 However, by doing that, they also lost
12 some of their flexibility in their flow window.

13 And, in 2012, in 2013, both units
14 transitioned to AREVA XM11 fuel. And, the MELLLA+
15 amendment was submitted last -- in the -- more than
16 last year, actually, November 2016.

17 The purpose of the increase the
18 operational efficiencies and also reduced need to move
19 the control rod especially near the end of the
20 operating cycle by expanding the license flow window
21 at full power from 80 to 104 percent total core flow.

22 Like Gregory mentioned, this is the first
23 time the application on top the original GEH licensing
24 topical report for the otherwise known as the GEH M+
25 LTR Methodology and also their AREVA Fuel XM11

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1 analysis.

2 This is, for us, it's a typical license
3 amendment. The structure of the application as a
4 usual introduction, no sig, et cetera.

5 But, the core of the application is the M+
6 SAR and also known as the BSEP Safety Analysis Report.

7 If pretty much follow the original GEH
8 MELLLA+ License Topical Report, and also the
9 integrated analyses from both GEH and AREVA, now known
10 as Framatome and others.

11 And then, we also dispositioned other
12 limitations and conditions spelled out in the License
13 Topical Reports.

14 And then, you include the markups. So,
15 this is a typical application of the core is the M+
16 SAR that we reviewed.

17 The major four changes requested are
18 pretty much typical to other MELLLA+.

19 The first is the Instrumentation Technical
20 Specification changes so that it will be consistent
21 with the M+ License Topical Report and mainly for the
22 DSS-CD methodology to control the stability of the
23 core.

24 And then, the next thing is the increase,
25 almost double, the standby liquid control boron

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1 enrichment. Actually, that has been physically
2 implemented at the plant already.

3 The third one is more important, is the
4 operational restrictions that was imposed before --
5 beyond the original EPU. Right now, with a request,
6 it will prohibit feedwater temperature reduction and
7 also single loop operations in the MELLLA+ domain.

8 And, lastly, some administrative changes.

9 Our staff reviewed approaches similar to
10 other MELLLA+ like Gregory mentioned earlier. We
11 addressed each section of the BSEP SAR and all the
12 applicable limitations and conditions spelled out in
13 the License Topical Report.

14 Our team conducted two audits. The first
15 one is a detailed Safety Analysis Audit of both GEH
16 and Framatome. That was done in Rockville here in
17 July last year.

18 And then, earlier this year, we went to
19 the site and audited the simulator and observed the
20 operator actions and we discussed with operators on
21 site.

22 And, our -- we sent the Committee a draft
23 SE about a month ago. At that time, our colleagues at
24 Research are still finishing up their TRACE study.
25 So, at that point, we included a placeholder in our

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1 draft report. Later on, we submitted a -- well, we
2 plugged in to summarize the result of the Research
3 TRACE study.

4 And, that, again, we heard yesterday,
5 that's specifically to model the Brunswick
6 configuration. And, that will give the complete
7 result.

8 I need to emphasize that what you saw is
9 kind of rough because we had to include the research
10 as a plug-in. Some of the references may not be
11 correct. The reference 30 in the plug-in actually is
12 pointing to the full report that Dr. Yarsky was
13 talking about yesterday. It hasn't been published
14 yet.

15 So, that is the full report. The research
16 is going to be submitted to the Committee if not have
17 done already. So, there's some disconnects in the
18 reference.

19 So, we are polishing the final SE and
20 there's little -- very little change in the technical
21 substance, especially the area we'll discuss today,
22 mostly just to make sure the references are consistent
23 and also some of the words will be better looking
24 back, you know, say it better this way.

25 But, you know, we did not change the

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1 substance. We will be submitting a final polished
2 version through Weidong and send it to the Committee
3 in about a month's time.

4 CHAIRWOMAN REMPE: Okay, just a second, so
5 make sure that I've got it on the record and that I
6 understand.

7 There will be some minor changes including
8 correlation of references or word changes so that
9 plug-in will be incorporated. And, you're going to
10 send us an updated version of the SE with no
11 substantial changes. And, that's going to come in?

12 MR. HON: I'm looking at about three, four
13 weeks time frame.

14 CHAIRWOMAN REMPE: Okay.

15 MR. HON: I want to through a technical
16 editor first so that we have it more polished.

17 CHAIRWOMAN REMPE: And so, it's real
18 important to have it to the Full Committee a month
19 ahead of time.

20 MR. HON: Yes.

21 CHAIRWOMAN REMPE: That's my understanding
22 is -- there were no open items in the SE that you gave
23 us that was a draft, so it looked pretty good.

24 But, we will not see any substantial
25 changes in it --

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1 MR. BORROMEO: So, this is Josh Borromeo
2 from the staff.

3 There is one change that you will see that
4 is semi-substantial. It's Limitation Condition 9.23
5 which is the Item Value Tracking that is supposed to
6 be submitted after the first MELLLA+ application.

7 GE has done that previously, so we said
8 that wasn't applicable for GE on MELLLA+ applications.
9 AREVA and Monticello came in like two years ago with
10 their EFW on MELLLA+ application.

11 Because of the lower power density of that
12 plant, we said it wasn't necessary for them to provide
13 us that -- all that data.

14 For Brunswick, however, since they're a
15 higher power density, we are going to be requesting
16 that data.

17 Right now, the SE says it's not applicable
18 but we have updated that and that's consistent with
19 what the licensee committed in a supplement to their
20 Safety Evaluation -- to their License Amendment
21 Request.

22 CHAIRWOMAN REMPE: Okay.

23 MEMBER MARCH-LEUBA: So that's going to be
24 a licensing commitment by the licensee or is it going
25 to be a limitation on the SER?

1 MR. BORROMEIO: It's applying with the
2 limitation and condition. Right now, they said this
3 -- originally, when they came in, they said this is
4 applicable. We did a non-accept with an opportunity
5 to supplement where we said, well, I think, you know
6 --

7 MEMBER MARCH-LEUBA: It's up to you, but
8 typically --

9 MR. BORROMEIO: Yes.

10 MEMBER MARCH-LEUBA: -- put it in the
11 licensing conditions --

12 MR. BORROMEIO: Yes, it will be
13 enforceable.

14 MEMBER MARCH-LEUBA: Yes, but this -- it's
15 unfortunate but because of the sunset provision that
16 the moment you send it back, this doesn't apply
17 anymore. It's kind of weird to do it that way.

18 MR. BORROMEIO: So, that's the only
19 substantial difference that you'll see.

20 CHAIRWOMAN REMPE: I'm going to really
21 emphasize, again, we have told you a lot, so we have
22 some flexibility.

23 MR. BORROMEIO: Right.

24 CHAIRWOMAN REMPE: So, this isn't the June
25 meeting or doing this letter and I didn't know about

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1 this.

2 MR. BORROMEO: Yes, we identified this
3 maybe a week or so after we sent the SE to --

4 CHAIRWOMAN REMPE: Okay. So, really try
5 hard to get this to us by the first of June, please.

6 MR. BORROMEO: Yes, absolutely. Although,
7 all the technical updates are -- I mean, the update is
8 already incorporated. It's --

9 CHAIRWOMAN REMPE: Okay. Again, I don't
10 think we care if it's gone through tech editing.

11 MR. BORROMEO: Okay.

12 CHAIRWOMAN REMPE: But, bet something to
13 ACRS that's not going to change a month in advance.
14 Okay?

15 MR. HON: Thank you.

16 CHAIRWOMAN REMPE: Thank you.

17 MR. HON: All right, we'll try to send you
18 sooner.

19 CHAIRWOMAN REMPE: Okay, thank you.

20 MR. HON: Like Josh said, we're not making
21 any substantial changes, just polishing it. Thank
22 you.

23 CHAIRWOMAN REMPE: Okay, thank you for
24 getting that on the record here.

25 MR. HON: Again, this is a very involved

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1 view. We have -- I want to acknowledge the review
2 team on the slide here, especially, of course, the
3 team leader and the support for my research that Dr.
4 Yarsky presented yesterday.

5 Today's presentation agenda is the
6 following. Because this is a combination of GEH and
7 Framatome technology, due to commercial agreement
8 limitations, there's not a full exchange of
9 information between the two vendors.

10 So, we want to be very careful to have the
11 closed sessions that are only applicable to one
12 vendor. So, we structured the presentation as
13 follows.

14 Following my presentation, licensee will
15 come and give an overview, that will be the public
16 session.

17 And then, after that, we take a break and
18 we'll excuse I think people who don't have access to
19 the GEH proprietary information and the licensee will
20 present that part after that.

21 The staff will present our result of the
22 review and then we'll swap people out. The only
23 people who have access to Framatome proprietary
24 information will stay at 10:40 or so and present the
25 -- I believe the aspect of the application.

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1 Likewise, the staff will immediately
2 follow that and present our results.

3 So, if it's okay with members of the
4 Committee, we'll follow that.

5 Again, this is a -- what I call an error
6 likely situation for spills so I hope that won't
7 happen today.

8 Thank you for your patience with the
9 arrangement.

10 With that, I'd like introduce Jane
11 Marshall which is our Deputy Director for the
12 Technical Division.

13 Jane?

14 MS. MARSHALL: As Andy said, my name is
15 Jane Marshall and I'm the Deputy Director for the
16 Division of Safety Systems in the Office of Nuclear
17 Reactor Regulation.

18 Today, we're presenting the staff review
19 of Brunswick Unit 1 and 2 MELLLA+ License Amendment
20 review.

21 The primary focus of NRR's review for this
22 application were the new approaches in areas that have
23 been historically challenging in these reviews.

24 To ensure consistency among reviews, the
25 staff used previous MELLLA+ reviews as well as

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1 relevant prior Tropical Report reviews.

2 While this review contains several new
3 items, I'd like to highlight the main technical
4 challenge for this review was the interface between
5 GEH methods and the Framatome fuel.

6 To support the NRR staff conclusions,
7 particularly the anticipated transient without SCRAM
8 instability, or ATWS-I calculations, the staff used
9 TRAC RELAP Advanced Computation Engine, or TRACE code,
10 confirmatory results which were completed by the
11 Office of Research and presented to the ACRS Thermal
12 Hydraulic Subcommittee yesterday.

13 These confirmatory results are intended to
14 help gain efficiency in the staff's review and help
15 flesh out any unknown issues.

16 In addition to the Office of Research
17 supporting the review, other offices from NRC
18 supported this review, many staff across NRR and we
19 contracted with Oak Ridge National Labs.

20 Thank you, and I'll now turn it over to
21 Josh Borromeo.

22 (OFF MICROPHONE COMMENTS)

23 MS. MARSHALL: Oh, licensee, I'm sorry.

24 CHAIRWOMAN REMPE: So, let's --

25 MS. MARSHALL: Turn it over to the

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1 licensee.

2 CHAIRWOMAN REMPE: -- go ahead and do that
3 since we had a tight schedule today. Okay.

4 Andy, can you hit escape again? Yes.

5 MR. NOLIN: We're good? We're good to go.

6 CHAIRWOMAN REMPE: Okay.

7 MR. NOLIN: Good morning. I'd like to
8 thank you for having Duke Energy here for the
9 discussion on MELLLA+.

10 I'm Jeff Nolin, I'm the General Manager of
11 Engineering at Brunswick.

12 We'll be presenting a few objectives for
13 the discussion today.

14 First, to show the need for MELLLA+, why
15 we're submitting the License Amendment, demonstrating
16 the key aspects of our request and demonstrating
17 readiness.

18 So, there was a discussion already today
19 about the key differences between integration of
20 AREVA, now Framatome, fuel and the GE methodology, so
21 demonstrating our readiness relative to the
22 integration of that aspect.

23 And, the request for submitting the
24 approval, we're looking for a third quarter 2018
25 implementation.

1 The reasons for that are Unit 2 is -- will
2 be approaching end of life in the current cycle. We
3 have a March 2019 refueling outage on Unit 2. So,
4 Unit 2 will be approaching a condition with final
5 feedwater temperature reduction in December. We would
6 like to implement in the fall of 2018.

7 We would like -- Duke Energy would like to
8 implement both units at the same time from an
9 integration of procedures, operator training,
10 consistency of maintaining the units.

11 MEMBER MARCH-LEUBA: So, then is Unit 1
12 already loaded? The core welding supports MELLLA+?

13 MR. NOLIN: Yes. So, Unit 1 and Unit 2,
14 in a couple of slides --

15 MEMBER MARCH-LEUBA: Okay, keep going.

16 MR. NOLIN: Perhaps the next slide, I get
17 to that exact question.

18 So, anyway, our intent is to integrate
19 both units at the same time and support for that
20 relative to the timing of the third quarter of 2018
21 because of the Unit 2 fuel cycle.

22 Next slide?

23 So, Brunswick Nuclear Plant, Brunswick
24 Steam Electric Plant is a two unit GE BWR-4 design.
25 We started commercial operation, Unit 2 was the lead

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1 unit in 1975, Unit 1 followed shortly after.

2 So, we have 42 and 43 years of operating
3 experience at Brunswick, so we are in the license
4 renewal period of extended operation for both units at
5 Brunswick.

6 Brunswick did do an extended power uprate
7 to 2923 megawatts thermal and we have been operating
8 in with EPU conditions for 13, 14 years now.

9 So, many of the prior license amendments
10 relative to MELLLA+ were integrated with the power
11 uprate. Brunswick has been operating with EPU for
12 more than a decade now on each unit.

13 And so, this license amendment is strictly
14 for MELLLA+, not the power uprate.

15 MEMBER SKILLMAN: Jeff, were you always
16 24-month operating cycle or were you 18 originally and
17 up bumped it 24? Mark, do I need to defer that to
18 you?

19 MR. NOLIN: Eighteen originally, we came
20 up to 24 months.

21 MEMBER MARCH-LEUBA: Mark, turn your
22 microphone on when you speak.

23 MR. DEWIRE: It is on.

24 MEMBER MARCH-LEUBA: Oh, it is on?

25 MR. NOLIN: No, no.

1 MEMBER MARCH-LEUBA: He was looking maybe

2 --

3 CHAIRWOMAN REMPE: What's the power
4 density of Brunswick? The Brunswick plants?

5 MR. YODERSMITH: We have a backup slide.

6 CHAIRWOMAN REMPE: I looked for it on the
7 backup slide, I didn't see the power density like
8 kilowatts per liter.

9 MR. YODERSMITH: Give me one second.

10 MR. BORROMEO: I think -- this is Josh
11 Borromeo --

12 MR. YODERSMITH: Page 20.

13 MR. BORROMEO: -- I think they're around
14 59 kilowatts per liter.

15 CHAIRWOMAN REMPE: Okay. It'd be good to
16 confirm that and you don't have to do it now, but --

17 MR. YODERSMITH: We -- sorry, we present
18 it in kilowatts per foot here.

19 CHAIRWOMAN REMPE: Okay. But, you think
20 it's 59 kilowatts per liter?

21 MR. BORROMEO: It was 4.9 kilowatts per
22 foot and here's how we stack up against the previous
23 submittals.

24 CHAIRWOMAN REMPE: Okay. So, again, I'd
25 like to know what it is kilowatts per liter. And,

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1 I've been told by the staff it's 59. Could you get
2 that confirmed for me today?

3 MR. YODERSMITH: Sure.

4 CHAIRWOMAN REMPE: Thank you.

5 MR. NOLIN: So, we are operating on a 24-
6 month fuel cycle. So, we have a refueling each March
7 on alternating units.

8 We did transition to Framatome fuel in
9 2008 in Unit 1, 2009 in Unit 2. So, we have
10 approximately a decade of operating experience with
11 Framatome fuel.

12 We are initially ATRIUM 10. We are a full
13 core ATRIUM 10XM fuel now. And, our licensed core
14 flow is 104.5 percent as was previously mentioned at
15 full power.

16 The project overview, the reason for the
17 submittal is to expand the flow window at full power.
18 The benefits of that is that we are required with the
19 current flow window to have multiple reactivity
20 manipulations for sequence exchanges.

21 So, the MELLLA+ will allow us to reduce
22 the number of downpowers, the number of reactivity
23 manipulations of the plant.

24 MEMBER MARCH-LEUBA: Jeff, on the top of
25 your head, how often do you change route, do you move

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1 those today?

2 MR. NOLIN: There's sequence exchange
3 quarterly.

4 MR. THOMAS: Sequence exchanges are about
5 every 2500 megawatt days per metric ton. And then, as
6 you get into the latter half of the cycle, maybe two-
7 thirds, we sometimes have to do them weekly to stay
8 within our flow window.

9 Essentially, it's the hot access
10 reactivity begins to drop off at the end of cycle.

11 MEMBER MARCH-LEUBA: So, about once a
12 week?

13 MR. THOMAS: Yes.

14 MR. YODERSMITH: Towards the end of cycle,
15 that's about what it is, about once a week, maybe --

16 MR. THOMAS: Yes, maybe two-thirds of the
17 way through the cycle.

18 MEMBER MARCH-LEUBA: So, MELLLA+ would
19 allow you to extend that probably for a month?

20 MR. THOMAS: Yes.

21 MR. YODERSMITH: Correct, at least.

22 MEMBER MARCH-LEUBA: It's a big, big
23 improvement.

24 MR. YODERSMITH: Yes.

25 MR. NOLIN: So, in addition to that, it'll

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1 help with recirc pumps, the operation of the recirc
2 pump seals has been a reliability issue for many
3 plants. And so, being able to expand the flow window
4 will also help improve recirc pump seal reliability.

5 So, it has some benefits beyond the
6 reactivity manipulations as well.

7 CHAIRWOMAN REMPE: So, I don't recall
8 other MELLLA+ applicants coming in and saying this
9 about the pump seals. And, is there evidence to say
10 yes, that's occurred with the ones that have gone in
11 to MELLLA+? Or have they not had much experience or
12 is this a well-substantiated issue?

13 MEMBER MARCH-LEUBA: I believe the issue
14 is, I mean, because they cannot go below 99 percent
15 flow, they have to be running at full power all the
16 time. The maximum you can crank out of them.

17 When they go to MELLLA+, they can be
18 running at 80 percent of it.

19 CHAIRWOMAN REMPE: But, is there evidence
20 to support this claim that it's really helping with
21 seals? I just -- I've not seen any other applicant
22 come in with that.

23 MR. THOMAS: I think it's the opposite.
24 I think it's the evidence is that the staying
25 consistently at the higher flows is adverse to the

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1 seals.

2 MR. NOLIN: We've seen since -- I
3 mentioned earlier that we have approximately a decade
4 at post-EPU. And, our experience was that the recirc
5 pump seals have been more challenged by operating at
6 a 100 percent flow consistently.

7 So that --

8 CHAIRWOMAN REMPE: Well, in the recent
9 years, you've seen --

10 MR. NOLIN: -- experience at Brunswick.

11 MR. DEWIRE: Yes.

12 CHAIRWOMAN REMPE: Have you had to replace
13 them?

14 MR. NOLIN: We're doing a design change to
15 the seals to support the sustained operation at high
16 flow. So, we're doing other things to improve recirc
17 pump reliability. But this will also help it.

18 CHAIRWOMAN REMPE: Okay, thank you.

19 MR. NOLIN: So, a prior question about
20 readiness for the station for implementation on each
21 unit. So, we've -- the Phase I prior to
22 implementation, plant modifications and training, we
23 did do the upgrade of our standby liquid control
24 system.

25 We increased the enrichment from 47

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1 percent to 92 percent on each unit. And, that is
2 complete.

3 We did the APRM EPROM modifications a
4 couple years ago in each unit. So, the physical
5 changes with the power range monitors have been
6 completed.

7 And, Mark DeWire, our senior license
8 holder will also discuss the operator training. So,
9 we've been through a couple of cycles of operator
10 training on MELLLA+ for readiness.

11 The implementation phase, we'll implement
12 --

13 MEMBER MARCH-LEUBA: Sorry, go back to
14 that. You do parallel training because you have to
15 train your operators to what is today applicable?

16 But then, on Friday afternoon you talk
17 about what you'll be doing next year?

18 MR. NOLIN: So, we have -- Mark will get
19 into that in much more detail.

20 MR. DEWIRE: Yes, if you can just hold
21 that question until I get up with my presentation,
22 then I'll address your question.

23 MEMBER MARCH-LEUBA: We'll wait.

24 MR. DEWIRE: Thank you, sir.

25 MR. NOLIN: So, the implementation phase

1 will consist of implementing the tech specs procedure
2 changes. We'll also go through a testing phase in the
3 MELLLA+ domain which will include level and pressure
4 perturbations in a series of five test conditions.

5 And then, the implementation of the detect
6 and suppress solution for the MELLLA+.

7 So, the plant is physically ready and the
8 implementation will be integrated on both units at the
9 same time.

10 With that, I'd like to turn it over to
11 Roger Thomas, he's our Manager in Nuclear Fuels.

12 MR. THOMAS: Thanks and, as Jeff said,
13 John Siphers was originally scheduled to give this
14 presentation, but because of the weather, his flight
15 was cancelled, so I am acting as his understudy today.

16 I am Manager of Brunswick Nuclear Design
17 which is a unit within John's group.

18 So, the focus of my part of the
19 presentation is something that's already been touched
20 on, is some of the unique aspects of our LAR compared
21 to some of the previous ones.

22 We, of course, did follow the generic
23 MELLLA+ LTR, but there was a division of labor between
24 Framatome and GE that will be described in greater
25 detail in some of the proprietary presentations.

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1 But, briefly, GEH, their division of labor
2 was to evaluate the overall plant response. They
3 focused on ATWS, ATWSI, long-term stability and DSS-
4 CD.

5 Framatome focused on those areas of the
6 analysis specific mostly to the fuels, the kinds of
7 analysis that you would typically see on a reload or
8 cycle specific basis.

9 As also previously been mentioned that GEH
10 and Framatome both have long and extensive experience
11 modeling the Brunswick plant.

12 GE, from initial startup, through extended
13 power operation and beyond, all the way to 2008 at
14 which time we transitioned to ATRIUM 10 fuel and in
15 2008. And then, later, in 2011, to ATRIUM 10XM.

16 Framatome has modeled the core and the
17 plant through that period all at extended power
18 uprate.

19 Another thing that might be unique is that
20 the cap credit, because we have had extended power
21 uprate for some time, we are proposing no changes to
22 our cap credit that we currently have.

23 MELLLA+ doesn't impact cap credit and the
24 NRC has a slide where they go into greater detail on
25 that. So, we're standing pat on that.

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1 All right, so, looking at vendor
2 methodology applicability, that's also something
3 that's been touched on. It's something that we were
4 challenged on early on.

5 Specifically, the challenge was, how --
6 are GE methods applicable to AREVA fuel, excuse me,
7 Framatome fuel? And, whether or not Framatome methods
8 are applicable in the expanded MELLLA+ flow regime?

9 So, starting with Framatome, there are no
10 SER restrictions on Framatome methodology that are
11 impacted by MELLLA+.

12 And, the Brunswick core and assembly
13 conditions that we will have in MELLLA+ are equivalent
14 to core and assembly conditions of other plants for
15 which Framatome's methodology was benchmarked.

16 And, of course, they elaborate on that in
17 the report that you see there in the first bullet.

18 GEH methods are applicable to MELLLA+, of
19 course, and they are capable of modeling Framatome
20 fuel.

21 There was an extensive transfer of
22 information about the characteristics and the
23 dimensions of the fuel from Framatome to GEH. GEH
24 explicitly modeled the ATRIUM 10XM fuel.

25 Duke had an interface role there where

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1 what we did is we developed a GEH thermal hydraulic
2 model for them in ISCOR. We translated the X-code
3 results. And, this is something we have done many
4 times in the past for other reasons. So, it was just
5 a matter of going a different direction.

6 And, in response to some RAIs, we also
7 provided steady state core simulator comparisons
8 between Framatome and GE and they showed excellent
9 agreement and excellent results.

10 And, they prove, for the purposes of the
11 work that GE is doing, that they could satisfactorily
12 model the ATRIUM, or excuse me, yes, the ATRIUM 10XM
13 fuel.

14 MEMBER MARCH-LEUBA: Roger, did I hear you
15 correctly, instead of passing -- you passing the
16 Framatome, call it equivalent diameter from the fuel
17 to GE, you actually rolled the ISCOR model for them?

18 MR. THOMAS: We created an ISCOR model for
19 them. And, it was the equivalent to Framatome's X-
20 cover modeling.

21 MEMBER MARCH-LEUBA: So, instead of
22 parsing the dimensions of the fuel --

23 MR. THOMAS: No, no, no.

24 MEMBER MARCH-LEUBA: -- you created --

25 MR. THOMAS: No, fuel dimensions were

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1 passed.

2 CHAIRWOMAN REMPE: So, in some of the
3 information I read, some dimensions might have been
4 passed, but they basically said, we gave -- GEH gave
5 a range of conditions or parameters and sent it over
6 the fence. And, AREVA or Framatome said, yes, that'll
7 bound it.

8 So, what exactly -- and maybe we could get
9 into the proprietary --

10 MR. THOMAS: That was -- yes, that's --

11 CHAIRWOMAN REMPE: -- and discussion, too.

12 MR. THOMAS: Yes, the details of that are
13 proprietary, but the concept is on, if not the next
14 slide, the slide after that.

15 CHAIRWOMAN REMPE: Okay.

16 MR. THOMAS: Okay, so, GEH key analysis,
17 so, this is where we speak to this a little bit.

18 So, in the previous slide, I mentioned
19 that GEH analyzed anticipated transient without SCRAM
20 and ATWS with instability.

21 The uncertainties and the ranges that you
22 mentioned are what AREVA provided were nominal
23 dimensions, nominal and so, GE identified to AREVA
24 what the important sensitive parameters would be in
25 their analyses.

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1 And, they said, can you give us the
2 uncertainties for these?

3 That's a very sensitive thing, so, what
4 they did is they bounded the ranges. I think it was
5 kind of like, you know, The Price is Right game,
6 higher, lower, higher, lower, ding, ding, ding, ding.
7 Okay, that'll bound it. All right? That's kind of
8 how it went.

9 And, Framatome will have to speak to how
10 those ranges actually bound their uncertainties. All
11 right?

12 Additionally, coming out of the LAR audit
13 that we had last July, GEH uses a different Tmin
14 correlation, I guess you would call it. And, or they
15 have a preferred one, but the NRC requested that they
16 provide -- they do additional sensitivities using the
17 homogeneous nucleation plus contact temperature model,
18 which I have to read to say that.

19 But, those were also provided in a
20 response to an LAR. And, I believe the key conclusion
21 here is, even with all of those parameters and
22 sensitivity studies applied, the results were still
23 favorable overall to the result and to support of the
24 MELLLA+ LAR.

25 So, again, there's a lot of proprietary

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1 information supporting those three bullets there, and
2 it will be addressed in some of the follow on.

3 All right, one of the things that we also
4 did, some of this has also been touched on a little
5 bit, is mitigating actions.

6 Clearly, MELLLA+ is a more challenging
7 area of operation for the plant. So, we wanted to
8 talk what actions made sense to sort of soften that
9 impact.

10 The first is the adoption of the Detect
11 and Suppress Solution Confirmation Density. We're
12 currently in Option 3 for non-MELLLA+ operation. We
13 will be transitioning to the DSS-CD for this which
14 adds the additional layer of checking and that
15 additional algorithms associated with that.

16 The second thing we did which Jeff also
17 touched on was we have already increased our SLCS B-10
18 enrichment from 46 to 92 or greater. And, what this
19 did for us is, it actually reduced the heat load and
20 suppression pool for the ATWS analyses in MELLLA+
21 relative to our original license condition.

22 So, in the box at the bottom, we compared
23 the two at 2436 and 75 percent flow which is several
24 power uprates ago that the result was 189 degrees.
25 And, you can see that there's an approximately 15

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1 degree improvement there which is a quantifiable
2 increase in the safety margin that we have for the
3 plant. So, that was a very positive result.

4 MEMBER MARCH-LEUBA: The other licensees
5 -- previous licensees have opted also to a speed up
6 their operation -- operator actions from 120 to 90
7 seconds, the water level reduction.

8 However, you decided to keep it at 120.

9 MR. THOMAS: Yes.

10 MEMBER MARCH-LEUBA: And, yesterday in
11 open session, we were told that in reality you're
12 trained to 96 seconds.

13 MR. THOMAS: That's right.

14 MEMBER MARCH-LEUBA: Which is 80 percent
15 of 120.

16 CHAIRWOMAN REMPE: So, there's some slides
17 coming up in this open session on this, so because I'm
18 going to try and keep us on schedule, I'd like to let
19 them have the opportunity to answer that question
20 later.

21 MR. THOMAS: Yes, that --

22 CHAIRWOMAN REMPE: I think it fits in a
23 better slide.

24 MR. THOMAS: Yes.

25 CHAIRWOMAN REMPE: Okay? Sorry.

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1 MR. THOMAS: That's okay.

2 Okay, and the final topic that I have is
3 Safety Limit MCPR. Unlike some of the previous
4 MELLLA+ LARs, we are proposing that there's no penalty
5 required for the safety limit MCPR in MELLLA+.

6 Framatome has a great deal of information
7 in their proprietary session that will support this.
8 But, what I can say is the primary concern that
9 prompted the previous penalties was the increased void
10 fractions and the concern that, as you move to those
11 increased void fractions you would see increases in
12 your uncertainties.

13 And, there was a lack of operating data to
14 justify those uncertainties.

15 Framatome will present operating
16 experience that includes data in those ranges that
17 validates the use of their existing uncertainties.

18 And, we will also present some Brunswick
19 specific information that shows that as we increase --
20 as we go along the line of increasing void fractions,
21 we do not see a negative trend in our applied
22 uncertainties. So, both of those will be presented in
23 the Framatome session.

24 So, the conclusion of that would be that
25 operation in the MELLLA+ region is within the analysis

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1 capabilities of Framatome methods and uncertainties
2 and so, no safety limit penalty is warranted.

3 So, with that, I'll turn it over to Mark
4 DeWire to address operator actions and training.

5 MR. DEWIRE: Good morning, I am Mark
6 DeWire. I'm Assistant Ops Manager for the Shift at
7 the Brunswick Nuclear Power Plant.

8 We're going to talk about operator
9 training. It was conducted in two cycles over the
10 year 2017 and it began in the spring, May/June time
11 frame where we started with just classroom discussion
12 which included a high level overview of the changes
13 that were coming and what we are intending to
14 accomplish.

15 Came back around in 2017 in the fall with
16 more classroom training which was on tech spec
17 changes, procedure updates and included a tech spec
18 workbook to allow the senior licensed operators to
19 work through that and understand the tech spec
20 changes.

21 And then, we also went into the simulator,
22 we did the hands on training, did demonstrations and
23 the hands on training where we focused more on the
24 time critical operator action of 120 seconds for
25 initiating water level reduction which get into your

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1 question.

2 So, the ATWS training's not a new concept.
3 We have been training -- always been training on ATWS.
4 The 120 seconds, we had started training to that a
5 year and a half to two years ago when we first knew
6 that MELLLA+ was coming our way.

7 So, we worked our way through that and we
8 designated it as a time critical operator action.

9 So, I'll keep going on to the next slides.

10 So, the operating crews were trained on
11 the time critical actions, as I mentioned. Each crew
12 was given three high power ATWS simulator scenarios to
13 be performed. And then, as mentioned earlier, in
14 February 2018, the NRC came down and did an audit and
15 observed the performance of the high power ATWS time
16 critical actions with no comments.

17 Twelve operating crews that --

18 MEMBER SKILLMAN: Can you back a slide,
19 please?

20 MR. DEWIRE: Yes, sir.

21 MEMBER SKILLMAN: So, the NRC comes down
22 and takes a look. Are the crews informed when the
23 event is going to occur or how to ensure that the crew
24 really knows when to take that action and that they're
25 not pre-staged waiting like a vulture to meet their

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1 120 seconds.

2 MR. DEWIRE: Right. So, that's a good
3 question.

4 So, the crews know there's an ATWS coming,
5 they're in there for that specific event, so you can't
6 hide that from them.

7 However, the plant is put through a
8 transient and then they worked their way into the
9 ATWS. So, they're not standing by with people at the
10 ready at various locations. They're dealing with a
11 simulator scenario and they're working their way in to
12 ultimately the ATWS actions on it.

13 So, I don't have people preprogrammed
14 standing over ready to go.

15 MEMBER SKILLMAN: That's probably as good
16 as you can do. So, thank you.

17 MR. DEWIRE: As mentioned, 12 operating
18 crews at three scenarios, so 36 total scenarios. The
19 average time was 85 seconds. The standard deviation
20 was 16 seconds. And, we were able to successfully
21 demonstrate that we could perform the time critical
22 operator actions within the 120 seconds and with
23 margin.

24 CHAIRWOMAN REMPE: Okay, so now I want to
25 stop and have you answer Jose's question about why not

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1 go to 96 seconds.

2 I also am curious, what was the longest
3 time someone took?

4 MR. DEWIRE: Hundred and twenty-one
5 seconds, one operating crew.

6 CHAIRWOMAN REMPE: So, that's above the 96
7 metric we were told about yesterday.

8 MEMBER MARCH-LEUBA: How about the 120 --
9 so, if you do 121, that will fail, right?

10 MR. DEWIRE: That's correct.

11 MEMBER MARCH-LEUBA: They have to retake
12 it?

13 MR. DESIRE: That's correct. So, they
14 fail the time critical operator action. So, we go
15 into the training process and they get remediated and
16 they do it again.

17 MEMBER MARCH-LEUBA: Remedial training, we
18 have people going through that.

19 MR. DEWIRE: So, the 120 -- so, the 85
20 seconds, when we get back to the 120 second question,
21 we did benchmarking and we brought in and we actually
22 changed the initial operator actions for reactor
23 operator.

24 We gave them a hard car where they could
25 secure the recirc pumps and they could initiate SLC

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1 based on their actions and reading the control board.

2 When we looked at other ways to get
3 leveled down rapidly required just to the design of
4 our plant, pretty significant engineering change to
5 get the level to come down with like the push of a
6 button or something like that. It takes operator
7 action.

8 And, when you incorporate INPO's IER 17-5
9 with leadership trades and maintaining command and
10 control, we felt prudent to maintain command and
11 control with the control room supervisor directing the
12 initiation of the reactor wide level reduction.

13 So, given that philosophy, we were able to
14 demonstrate right around 85 seconds is where we come
15 in with that time critical. Maintaining the command
16 and control yet allowing the operator to take actions.

17 MEMBER MARCH-LEUBA: So, you're saying the
18 design of the control -- the pump control requires you
19 to roll them back slowly? You cannot just read them?

20 MR. DEWIRE: They do. They run -- they
21 get run back on the SCRAM signal from the reactor
22 protection system and then --

23 MEMBER MARCH-LEUBA: No, I'm talking --
24 sorry, I was talking about -- I said pumps, I meant
25 feedwater pumps.

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1 MR. DEWIRE: The feedwater pumps are
2 directed from -- so, the order to terminate and
3 prevent will come from the control room supervisor
4 then the reactor operator would take action, it would
5 be another hard car.

6 MEMBER MARCH-LEUBA: How long does it take
7 to terminate and prevent?

8 MR. DEWIRE: Eighty-five seconds.

9 MEMBER MARCH-LEUBA: No, no, I mean, it
10 probably takes 80 seconds to start --

11 MR. DEWIRE: All right, so the valve
12 strokes on the feedwater systems are probably around
13 80 seconds for them to complete total stroking. But,
14 the one feed pump is tripped off, the other feed pump
15 is run down, it's discharged pressure so it cannot
16 inject.

17 So, it's terminated that way and you're
18 waiting on the valves for the prevention.

19 MEMBER MARCH-LEUBA: Okay, thank you.

20 MEMBER SKILLMAN: How significant were the
21 changes to the operating procedures to accommodate the
22 successful outcome here?

23 MR. DEWIRE: Not very, the only --

24 MEMBER SKILLMAN: Just a couple of --

25 MR. DEWIRE: Yes, the only thing we really

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1 added was we allowed the RO more flexibility to take
2 action at the control board with the initiation of SOC
3 and the tripping of the recirc pumps.

4 MEMBER SKILLMAN: Okay, thank you.

5 CHAIRWOMAN REMPE: So, is this the only
6 time critical operator action associated with MELLLA+
7 or does the initiation of like SLC injection --

8 MR. DEWIRE: SLC injection of less than
9 five minutes is a time sensitive with -- time
10 sensitive operator action.

11 CHAIRWOMAN REMPE: But, it's not time
12 critical, it's a different --

13 MR. DEWIRE: Right, it's a different
14 category.

15 CHAIRWOMAN REMPE: -- category and how you
16 train for it and treat it?

17 MR. DEWIRE: Right. But, again, we added
18 that to the hard car so that was one of the immediate
19 actions that the rad dropper is going to take.

20 MEMBER MARCH-LEUBA: Plus, in my
21 experience the SLC -- the boron injection always
22 happens before it's needed because the EOP's still
23 your -- if you think you're going to get there, push
24 the button, is that correct?

25 MR. DEWIRE: Right. So, he's going to

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1 look at power level and if it's greater than a certain
2 percent, he's going to initiate SLC.

3 MEMBER MARCH-LEUBA: And then --

4 MR. DEWIRE: But, that boron enrichment,
5 I've been there since '95, licensed since 2000. It is
6 a significant difference with that enriched boron and
7 how fast power comes down.

8 MEMBER MARCH-LEUBA: Yes, but what -- I
9 was trying to say is that the boron injection time,
10 you can call it critical, you never -- your crews are
11 never going to fail it, right? Is that your
12 experience?

13 MR. DEWIRE: Right, it's pretty quick
14 right off the bat.

15 CHAIRWOMAN REMPE: Are we good to go on
16 guys?

17 MR. DEWIRE: All right.

18 CHAIRWOMAN REMPE: Thank you.

19 MR. DEWIRE: Yes, ma'am.

20 So, in conclusion, implementation of the
21 MELLLA+, we're talking about the benefits, greater
22 flexibility in using core flow to control reactivity.
23 That's near and dear to my heart as an operator with
24 reactivity manipulation in a cycle.

25 Reduces the number of plant downpowers,

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1 reactivity manipulations and increases the station's
2 capacity factor for the operating cycle.

3 We'll be ready to implement MELLLA+
4 License Amendment, we talked about the installation of
5 the hardware changes with the DSS-CD firmware and the
6 SLC enrichment.

7 We've completed training on MELLLA+, the
8 procedures and required operator actions.

9 The final PRNM nuclear monitoring setpoint
10 engineering change is being finalized and
11 implementation of a test plan has also been
12 established.

13 And, with all that, we're -- as mentioned,
14 we're requesting approval for the third quarter of
15 2018 implementation.

16 MEMBER MARCH-LEUBA: So, go to MELLLA+,
17 you don't have to change any hardware other than
18 EPROMs and things like that?

19 MR. DEWIRE: That's correct. It's already
20 installed, it's a matter of turning it on.

21 MEMBER MARCH-LEUBA: Good, perfect.

22 CHAIRWOMAN REMPE: So, despite the fact
23 we're a little bit behind, there's a slide 22 that you
24 prepared and I just would like you to -- it's a backup
25 slide and I was looking through your backup slides

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1 before the meeting -- that one. Could you talk a
2 little bit about that one, please?

3 MR. YODERSMITH: Yes, so this is our -- my
4 name is Stephen Yodersmith with Duke Energy.

5 So, this is our test conditions that we'll
6 be walking through during our test window. So, we'll
7 start at test condition A and that'll be where we
8 start our testing window.

9 And then, we'll come down to each of these
10 test points, B, C, D, E and the various testing at
11 those points to collect data for MELLLA+ transition.

12 And then, after --

13 MEMBER MARCH-LEUBA: Stephen, those test
14 points, is that when you're testing your control
15 systems, I think?

16 MR. YODERSMITH: That's correct.

17 So, yes, let me get to --

18 MEMBER MARCH-LEUBA: You'll be performing
19 perturbations on your systems, CD control work fine?

20 MR. YODERSMITH: So, we'll be performing
21 perturbations on the control systems, pressure
22 testing. We'll also be gathering TIP data so that
23 test condition A, we'll be gathering TIP data.

24 And also, at test condition E, we'll be
25 gathering TIP data.

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1 MEMBER MARCH-LEUBA: That'll be transient
2 TIP, you know, are you going to wait there for 12
3 hours?

4 MR. YODERSMITH: So, it'll be steady
5 state, not steady state xenon, it'll be steady state
6 power level, so we won't wait there for 12 hours, but
7 we will come to that test condition.

8 MEMBER MARCH-LEUBA: Only for one hour?

9 MR. YODERSMITH: That's -- yes, it usually
10 takes about four hours to get the TIP data, so we'll
11 sit there for that time period. We'll ask operations
12 to maintain power at that power level. And so, it'll
13 be a good TIP set which is consistent with the way we
14 gather TIP --

15 MEMBER MARCH-LEUBA: Actually, with
16 MELLLA+ we suggest comparison or you know harder to do
17 for the computer guys.

18 MR. YODERSMITH: Yes, that's right. And
19 so, this supports our, you know, we're taking TIP set
20 down at this test condition E in support of what was
21 discussed earlier that we don't need a safety penalty.

22 And so, this will be -- this will provide
23 additional confirmation that, yes, our uncertainties
24 at this lower point, this higher power flow point
25 don't show any inconsistencies with our uncertainties

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1 at the more normal operating conditions.

2 MEMBER MARCH-LEUBA: Maybe I should ask
3 the staff about this, but is this a licensing
4 condition? It's not on the SER.

5 MR. YODERSMITH: We --

6 MEMBER MARCH-LEUBA: This second
7 amendment?

8 MR. YODERSMITH: Yes, that's correct, yes.

9 MEMBER MARCH-LEUBA: I think we're in
10 that, which I like better than a condition on the SER
11 because once you've done it, you don't have to do it
12 again.

13 MR. YODERSMITH: Yes, so our plan is to
14 take this data during MELLLA+ startup. The plan is
15 not to collect data here regularly, and so, our plan
16 is, hey, we're going to -- on each unit, we're going
17 to go collect that TIP data at that test condition and
18 analyze it and make sure it's within our existing
19 license uncertainties.

20 And then, if there's no plans to
21 consistently get data there, but we will get it before
22 we allow operation in the MELLLA+ region.

23 MR. MARCH-LEUBA: Thank you.

24 CHAIRWOMAN REMPE: Yes, thank you.

25 MR. YODERSMITH: You're welcome.

1 CHAIRWOMAN REMPE: That helps with our
2 review.

3 MEMBER SKILLMAN: Let me ask this, please.
4 As I look at your slide 17 which is your conclusion,
5 what jumps out at me is the DSS-CD firmware.

6 And, the question I'd like to ask is this,
7 what confidence does the station have that the EPROM
8 and the other changes that are essential for this
9 amendment are what those EPROM and other hardware
10 changes need to be to stay within your -- the envelop
11 for which you seek approval?

12 MR. YODERSMITH: We're very confident in
13 the DSS-CD firmware so --

14 MEMBER SKILLMAN: Why are you confident?

15 MR. YODERSMITH: So, as part of the
16 engineering change package that we did in 2016 when
17 this firmware was installed, we did extensive factory
18 acceptance testing and we also did extensive site
19 acceptance testing of the firmware itself.

20 So, knowing that we've got the latest and
21 greatest firmware from GE with the latest and greatest
22 DSS-CD solution loaded on there, so extensive SAT
23 testing.

24 We are currently operating with Option 3,
25 so we've got the settings set such that Option 3 is

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1 our primary solution and DSS-CD is not active.

2 As part of our engineering change package
3 that will be implementing upon MELLLA+ approval, we'll
4 do extensive site acceptance test -- additional site
5 post-mod testing would be the right term for it.

6 After we put in the new setpoints, we'll
7 run through our MST, our maintenance surveillance test
8 procedures for those EPROMs which will have been
9 checked out at GE beforehand and run through and make
10 sure that, yes, we are getting the trips where we're
11 supposed to get the trips.

12 We are getting the annunciators where
13 we're supposed to get the annunciators and we'll run
14 through all that testing as part of post-mod testing.

15 MEMBER SKILLMAN: For the documentation
16 for that change package --

17 MR. YODERSMITH: Yes, sir?

18 MEMBER SKILLMAN: -- to what extent was
19 that covered by GE's and/or your Appendix B program?

20 MR. YODERSMITH: Yes, so the -- all the
21 documents -- the sworn documents that we got from GE
22 in support of that mod were developed in accordance
23 with their Appendix B program. And, our engineering
24 change process is to our engineering change to our
25 Appendix B program.

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1 MEMBER SKILLMAN: Yes, sir, thank you.

2 MR. YODERSMITH: Yes, sir.

3 MEMBER MARCH-LEUBA: And, just follow up
4 on a tiny detail, do you do a hash of the firmware to
5 make sure -- in many times of digital controls, people
6 put the wrong EPROM. The manufacturer will send you
7 the wrong EPROM to use in the plant.

8 MR. YODERSMITH: Yes.

9 MEMBER MARCH-LEUBA: I mean, the Unit 1
10 and Unit 2 are there to any one?

11 MR. NOLIN: There's a significant process
12 relative to digital changes of the nuclear plant
13 today. So, the firmware and software revision levels
14 are required to be verified by the change and any
15 subsequent PM replacements are corrective maintenance.

16 MEMBER MARCH-LEUBA: When you download a
17 program from the internet, the good size, that's what
18 gives you hash that you can check that it hasn't
19 changed.

20 MR. NOLIN: That's right.

21 MEMBER MARCH-LEUBA: It would be
22 worthwhile to think about it.

23 MR. YODERSMITH: Yes, so the --

24 MEMBER MARCH-LEUBA: Maybe GE needs to
25 think about it.

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1 MR. YODERSMITH: The EPROMs were hashed at
2 GE's facility --

3 MEMBER MARCH-LEUBA: They were?

4 MR. YODERSMITH: -- before they were
5 packaged to verify that, yes, this is exactly what we
6 need and what was tested during the FAC.

7 MEMBER MARCH-LEUBA: Okay.

8 MR. YODERSMITH: And then, they were sent
9 to site using our cybersecurity process which allow --
10 which requires certain tamper tape to be installed on
11 the boxes and other provisions before they can be
12 accepted at site to be installed.

13 So, we've followed our cybersecurity rules
14 as far as purchasing firmware.

15 MEMBER MARCH-LEUBA: Joy's going to say we
16 leave it, I love what you said. I'm wasting time.
17 But, I love you said you think of cybersecurity over
18 receiving the wrong EPROM. Typically, you don't think
19 of a cybersecurity on USB drives, on CDs, on the
20 internet.

21 MR. YODERSMITH: Oh, yes.

22 MEMBER MARCH-LEUBA: But, even an EPROM,
23 your cybersecurity has a plan for it.

24 MR. YODERSMITH: Yes, that's right. Anything
25 digitally related, our cybersecurity program gets into

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1 the purchasing requirements of that.

2 MEMBER MARCH-LEUBA: That's really good,
3 thank you.

4 CHAIRWOMAN REMPE: Because you want to
5 catch your plane, I'm going ahead at this point.

6 We're going to -- I think we're done with
7 this session. And, I'm going to ask for public
8 comments because this is going to be the end of the
9 open portion of the meeting.

10 So, can you get the line open? And, is
11 there anyone in the room who wishes to make a comment?

12 (NO RESPONSE)

13 MR. BROWN: The line's open.

14 CHAIRWOMAN REMPE: Okay. Is anyone on the
15 line who wishes to make a comment or if there's anyone
16 out there, if you just would confirm that you're
17 there, it would help us to know that there's someone
18 out there.

19 (NO RESPONSE)

20 CHAIRWOMAN REMPE: I'm not hearing
21 anybody.

22 PARTICIPANT: We're here.

23 CHAIRWOMAN REMPE: Oh, okay, that's good.

24 PARTICIPANT: We're here, yes.

25 CHAIRWOMAN REMPE: Any comments?

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1 PARTICIPANT: None.

2 CHAIRWOMAN REMPE: Okay, not hearing any
3 comments, I'm going to --

4 (OFF MICROPHONE COMMENTS)

5 CHAIRWOMAN REMPE: So, not hearing any,
6 I'm going to close the open session.

7 We're going to take a ten minute break.
8 And so, will the first folks, I think it's GEH and the
9 licensee, if they'll be at the front at 10:30 or 9:35,
10 we'll start up with that.

11 And, during this ten minutes, whoever
12 needs to check, make sure that the other folks aren't
13 in the room. Okay?

14 Thank you.

15 (Whereupon, the above-entitled matter went
16 off the record at 9:25 a.m.)

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ACRS Power Uprate Subcommittee

Brunswick Steam Electric Plant Units 1 & 2

Maximum Extended Load Line Limit Analysis Plus (MELLLA+)

May 16, 2018



Introduction

Andy Hon, *PE*

Project Manager

**Division of Operation Reactor Licensing
Office of Nuclear Reactor Regulation**

Brunswick MELLLA+ Background

- 20% EPU was approved in 2002 but reduced the licensed flow window at the new licensed full power level from ~24% to 6% total core flow.
- Transitioned to full core AREVA (Framatome) fuel in in 2008/2009 and ATRIUM 10XM full core in 2012/2013.
- MELLLA+ amendment request was submitted 11/9/2016 to increase operational efficiencies and reduce control rod manipulations - expanding the licensed flow window at full power by ~20% to 85-104.5% total core flow.
- First LAR adopting approved licensing topical reports (LTR) for both GEH (TRACG) and AREVA ATRIUM™ 10XM fuel.

LAR Contents

- LAR Body
 - Introduction, No Significant Hazards Consideration, etc.
- BSEP Safety Analysis Report (M+ SAR)
 - Follows the Approved GEH MELLA+ LTR NEDC-33006
 - Integrates analyses from GEH, AREVA (Framatone) and others
- Disposition of Limitation and Conditions from the LTR SEs.
- Proposed Mark-ups of license changes
- Supporting documents

LAR Major Topics - similar to other MELLLA+

- T.S. Instrumentation consistent with the LTR and other plants to implement the Detection Suppression Solution – Confirmation Density (DSS-CD) for Rx core T-H stability.
- Standby Liquid Control (SLC) Boron Enrichment increased from 47% to 92%.
- Operational Restrictions – prohibit FW Temperature Reduction and Single Loop Operations in MELLLA+ domain.
- T.S. Administrative Requirements changes

- Similar to other plants' MELLLA+ SE
- Addressed each section of the BSEP SAR and applicable LTRs' L&Cs
- Included a summary of RES sensitivity study using TRACE computer modelling of Brunswick MELLLA+ conditions.
- Conducted two audits
 - Safety analyses – July 2017 in Rockville
 - Simulator – February 2018 on site



NRC Staff Review Team

Office of Nuclear Reaction Regulation		
J. Borromeo (Lead)	M. Biro	M. Breach
M. Chernoff	J. Dozier	A. Hon
J. Hughey	D. Ki	M. Panicker
A. Sallman	R. Stattel	A. Smith
M. Smith	A. Wysocki (ORNL)	
Office of Nuclear Regulatory Research		
A. Bielen	K. Gibson	C. Gingrich
N. Hudson	J. Staudenmeier	P. Yarsky

Agenda

Time	Presenter(s)	Topic
08:30	ACRS	Opening introduction
08:35	NRC staff	Review introduction
08:45	Licensee	LAR overview
09:15	ACRS	Public comments
09:20		Break
Closed Sessions Below		
09:30	Licensee/FR	LAR details (Framatome proprietary)
10:05	Licensee/GEH	LAR details (GEH proprietary)
10:40	NRC staff/ORNL	Review details (GEH proprietary)
11:15	NRC staff/ORNL	Review details (Framatome proprietary)
11:45	ACRS	Discussions and closing remarks
12:00		Meeting adjourn



Technical Staff Management Representative Opening Remark

Jen Whitman

**Acting Branch Chief
Reactor System Branch
Division of Safety Systems
Office of Nuclear Reactor Regulation**



**Brunswick Steam Electric Plant Units 1 and 2 MELLLA+
(Maximum Extended Load Line Limit Analysis Plus)**

Advisory Committee on Reactor Safeguards Subcommittee Meeting



BSEP Station Overview and MELLLA+ Project Overview

Jeff Nolin – BSEP GM Nuclear Engineering

Objectives

Show Need for MELLLA+

Describe Key Aspects and Answer Questions

Demonstrate Readiness

Requested Approval supporting 3Q 2018 Implementation

BSEP Station Overview

- General Electric BWR-4, Mark I Containment
- Began commercial operation in 1975 (Unit 2) and 1976 (Unit 1), OLTP 2436 MWt
- EPU (120% OLTP) 2923 MWt fully implemented in 2004 (Unit 1) and 2005 (Unit 2)
- 24 month operating cycle
- Transitioned to Framatome Fuel in 2008 (U1) and 2009 (U2)
- Full Core Framatome ATRIUM 10XM Fuel
- Licensed for Increased Core Flow (ICF) (110% at reduced power, 104.5% at CLTP 2923 MWt)

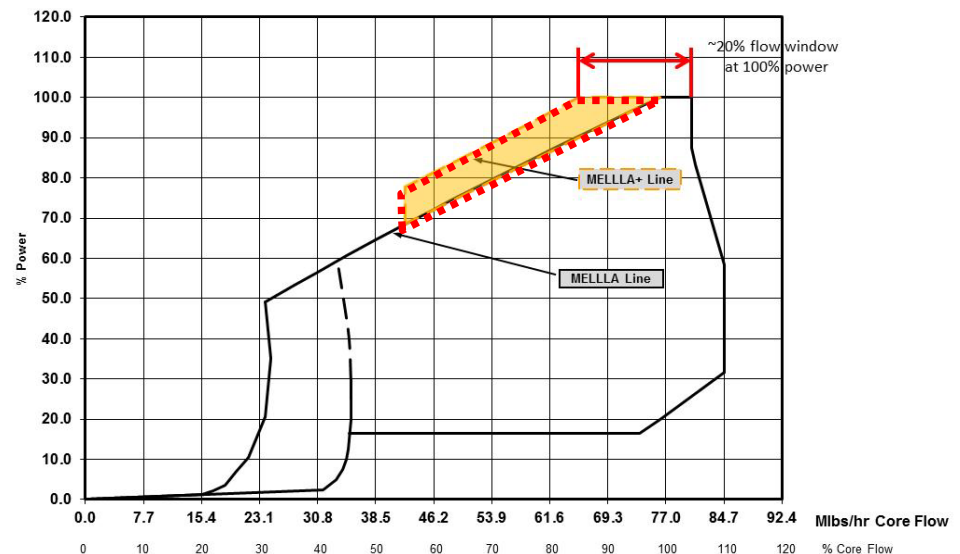
MELLLA+ Project Overview – Background and Benefits

Background

- EPU reduced the licensed flow window at rated power from approximately 24% to 6% Total Core Flow. MELLLA+ will expand the licensed flow window at 100% power from 99-104.5% to 85-104.5% Total Core Flow.

Benefits

- Fewer reactivity manipulations
- Reduction in down-powers
- Increase station capacity factor
- Lower Reactor Recirculation Pump (RRP) speeds:
 - increase RRP seal lifetime
 - increase net electric generation due to lower pump power usage



MELLLA+ Project Overview – Implementation Progress and Plans

- Phase 1 (Pre-MELLLA+ Approval) – Plant Modifications and Training
 - Standby Liquid Control (SLC) Boron-10 (B10) enrichment upgrade (Completed in 2016 & 2017)
 - APRM EPROM modifications (Completed Mid 2016 on both Units)
 - Plant Operators Introduced to MELLLA+ (2017 Cycle 3 Training)
 - Operators provided with overview of hardware and procedure changes including revised Power/Flow maps along with simulator exercises on new time critical operator action. (2017 Cycle 6 Training)

- Phase 2 (Post MELLLA+ Approval) – Online Updates and Testing
 - Implement new Technical Specifications, Engineering Changes (ECs), Procedures
 - Special Testing in MELLLA+ Domain including Level Control, Pressure Control, APRM / LPRM / TIP / OPRM data evaluations, Fuel Thermal Margins, Recirc System Performance, and Moisture Carryover
 - Transition to Detect & Suppress Solution – Confirmation Density (DSS-CD) Stability Option from Option III

MELLLA+ Design and Analyses

John Siphers – GM Nuclear Fuel Design

MELLLA+ Design and Analyses

- The M+ SAR follows the guidelines contained in the generic MELLLA+ Licensing Topical Report (M+LTR), NEDC-33006P-A.
 - Although the M+LTR is a product of GEH, BSEP utilizes Framatome A10XM fuel. As such, the safety evaluations provided in the M+SAR are the results from both GEH and Framatome.
 - GEH evaluated the overall plant response with M+, ATWS, ATWSI and long term stability solution DSS-CD. GEH has a long experience of modeling BSEP from startup through EPU operation.
 - Framatome performed the remaining typical reload specific fuels analyses. Framatome has been modeling BSEP at EPU conditions since the original ATRIUM 10 transition in 2008 and ATRIUM 10XM since 2011.
- Consistent with the M+LTR, the evaluation of BSEP Emergency Core Cooling System Net Positive Suction Head demonstrated there is no adverse impact and therefore no change to Containment Accident Pressure credit is warranted with MELLLA+.

MELLLA+ Design and Analysis – Vendor Methodology Applicability

- ANP-3108P, Applicability of Framatome BWR Methods to Brunswick Extended Power Flow Operating Domain (EPFOD)
 - No SER restrictions on Framatome methodology that are impacted by EPFOD
 - BSEP core and assembly conditions in MELLLA+ are equivalent to core and assembly conditions of other plants for which the methodology was benchmarked
- GEH methods are applicable to MELLLA+ and are capable of modeling Framatome fuel
 - Transfer of information from Framatome to GEH allowed explicit modeling of the fuel
 - Duke developed and provided a GEH thermal hydraulic model (ISCOR) for ATRIUM 10XM
 - NRC RAI SRXB-RAI-11 response provided steady-state core simulator comparisons for BSEP MELLLA+ cycle using GEH and Framatome methods
 - Shows GEH methods modeled the A10XM fuel and core characteristics in a satisfactory manner

MELLLA+ Design and Analysis – Key GEH Analyses

- GEH analyzed Anticipated Transient Without Scram (ATWS) and ATWS with Instability (ATWSI) scenarios.
- To address the effect of any uncertainty in GEH modeling A10XM, fuel parameter sensitivities were performed.
- For ATWSI, additional sensitivities were executed utilizing the homogenous nucleation plus contact temperature model for T_{\min} and plant data was utilized to determine an appropriate feedwater temperature reduction rate.

MELLLA+ Design and Analysis – Key MELLLA+ Mitigating Actions

- BSEP will transition from Option III to Detect and Suppress Solution – Confirmation Density (DSS-CD) for thermal hydraulic stability (THI) protection. To set the DSS-CD amplitude discriminator, GEH analyzed BSEP limiting events to demonstrate adequate margins.
- BSEP increased the Standby Liquid Control System (SLCS) B-10 enrichment (47 to 92% B-10) such that the ATWS heat load to the suppression pool was reduced at 2923 MW_{th}/85% flow when compared to original power 2436 MW_{th}/75% flow conditions (19.8% B-10).
 - 2436 MW_{th}/75% Flow peak pool temperature was 189.4 F while EPU/MELLLA+ is 174.0 F.

MELLLA+ Design and Analysis – SLMCPR

- BSEP does not have any SLMCPR penalties for operation in EPU. No additional SLMCPR penalty is warranted for MELLLA+.
- The primary concern prompting a penalty is increased void fractions due to operation at higher power/flow ratios and lack of operating data to justify current licensing uncertainties.
- Framatome operating experience includes data that validates use of existing uncertainties with Framatome methods at the BSEP MELLLA+ high power/flow ratios.
- Therefore, operation in the MELLLA+ region is within the analysis capabilities of Framatome methods and uncertainties and no SLMCPR penalty is warranted.

Operator Actions and Training

Mark DeWire – BSEP Assistant OPS Manager - Shift

Operator Actions and Training – Overview

Operator Training was Conducted During Two Cycles of 2017

- Cycle 3 (May/June 2017)
 - MELLLA+ Introduction (Classroom Only)
- Cycle 6 (Oct/Nov 2017)
 - MELLLA+ Procedure and Equipment Changes (Classroom)
 - MELLLA+ Tech Spec Workbook (Classroom)
 - Equipment Demonstrations (Simulator)
 - ATWS Proficiency Training (Simulator)
- Operator training included training on:
 - MELLLA+ Operating Restrictions, Technical Specification changes, and procedure updates
 - Time Critical Operator Action (TCOA) to initiate reactor water level reduction during ATWS within 120 seconds

Operator Actions and Training – ATWS Time Critical Operator Actions

ATWS TCOA Training

- Operating crews were trained on MELLLA+ ATWS time critical actions
- Three high power ATWS simulator scenarios performed per crew
- February 2018 NRC Audit observed performance of high power ATWS time critical actions

Operator Actions and Training – ATWS Time Critical Operator Actions

ATWS TCOA timing results:

- 12 operating crews were timed initiating ATWS reactor water level reduction (36 scenarios)
- Average time to initiate reactor water level reduction was 85 seconds
- Standard deviation was 16 seconds
- Operating crews have demonstrated ability to perform TCOA within required times with margin

Conclusions

Implementation of MELLLA+ will provide significant benefits:

- Operators will have greater flexibility in using core flow to control reactivity
- Reduces the number of plant downpowers and reactivity manipulations
- Increases the station's capacity factor during the operating cycle

Brunswick will be ready to implement the MELLLA+ License Amendment

- Installation of the DSS-CD firmware and SLC enrichment change complete
- Training on MELLLA+ equipment, procedures and required operator actions is complete
- Final PRNM setpoint Engineering Change is being finalized
- Implementation test plan established

Requested Approval supporting 3Q 2018 Implementation

Questions