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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
(ACRS)
+ + + + +
POWER UPRATES SUBCOMMITTEE
+ + + + +
THURSDAY, MAY 24, 2012
+ + + + +
OPEN SESSION
+ + + + +
ROCKVILLE, MARYLAND

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

SUBCOMMITTEE MEMBERS PRESENT:

JOY REMPE, Chair
J. SAM ARMIJO
SANJOY BANERJEE
STEPHEN P. SCHULTZ
WILLIAM J. SHACK
JOHN D. SIEBER
GORDON R. SKILLMAN

CONSULTANTS TO THE SUBCOMMITTEE PRESENT:

MARIO V. BONACA

GRAHAM B. WALLIS

NRC STAFF PRESENT:

JOHN LAI, Designated Federal Official

LOUISE LUND

MIKE MARKLEY

MUHAMMAD RAZZAQUE

TAI HUANG

ANTHONY ULSES

SWAGATA SOM

BERNARD DITTMAN

DAN WIDREVITZ

BILLY JESSUP

THERON BROWN

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

(8:30 a.m.)

CHAIR REMPE: I'd like to call the meeting to order. Is that okay, Mr. Recorder? Are you ready? Okay.

This is the meeting of the Power Uprates Subcommittee and I'm Joy Rempe and I will be chairing this session.

ACRS members in attendance include Jack Sieber, Dick Skillman, Steven Schultz, Sam Armijo, Bill Shack and then we have two consultants, Mario Bonaca and Graham Wallis. And then we have several members who are not quite here but will be coming in, including Sanjoy Banerjee, Mike Ryan, and Mike Corradini. Did I miss anyone? Okay, good.

Okay, John Lai of the ACRS staff is the Designated Federal Official for this meeting.

Today we are going to hear presentations from the NRC staff, the contractors, and Entergy Operations to discuss the Grand Gulf Nuclear Station Unit 1, license amendment request for an extended power uprate.

There will be a phone bridge line and to preclude interruption of the meeting, the phone will be placed in a listen-in mode during the presentations

1 and subcommittee discussions.

2 A portion of this meeting may be closed in
3 order to discuss and protect information that has been
4 designated as proprietary by NRC, pursuant 5 USC
5 552(b)(4).

6 We have received no written comments or
7 requests for time to make oral statement from members
8 of the public regarding today's meeting.

9 Today the subcommittee will gather
10 information, analyze relevant issues and facts and
11 formulate proposed positions and actions as
12 appropriate for deliberation by the full committee.

13 The rules for participation in today's
14 meeting have been announced as part of the notice of
15 this meeting previously published in the *Federal*
16 *Register*. A transcript of the meeting is being kept
17 and will be made available as stated in the *Federal*
18 *Register* notice. Therefore, we request that
19 participants in this meeting use the microphones that
20 are located throughout the meeting room when
21 addressing the subcommittee. The participants should
22 first identify themselves and speak with sufficient
23 clarity and volume so they can be readily heard.

24 We are now going to proceed with the
25 meeting and I would like to call on Ms. Louise Lund of

1 the NRC staff to begin.

2 MS. LUND: Thank you very much. I'm
3 Louise Lund. I'm the Deputy Division Director for the
4 Division of the Operating Reactor Licensing in NRR.
5 And this morning I'm here to present our review of an
6 application we received on September 10, 2010 and
7 supplemented by the licensee requesting an amendment
8 for an Extended Power Uprate for Grand Gulf Nuclear
9 Station Unit 1 to increase the license thermal power
10 from 3,898 megawatts-thermal to 4,408 megawatts-
11 thermal.

12 And as you know, Grand Gulf is the Boiling
13 Water Reactor owned and operated by Entergy. And to
14 support the EPU, the licensee made several extensive
15 physical modifications during a recent current
16 refueling outage to systems necessary to accommodate
17 the Extended Power Uprate. You will hear about those
18 in the presentation today.

19 And the EPU was extended longer than a lot of
20 our recent reviews because Grand Gulf is the first
21 application of the Plant Based Load Evaluation
22 methodology for the steam dryer review. So you will
23 be hearing a lot about that today as well.

24 And I just wanted to also add that I know
25 we have had a number of reviews ready for ACRS

1 meetings for power uprates recently and we really
2 appreciate the committee's willingness to get all of
3 these things scheduled because I know they all came in
4 a clump together. So we appreciate your willingness
5 to help us get all these scheduled together. So thank
6 you.

7 CHAIR REMPE: Thank you. Do you want to
8 introduce the first speaker?

9 MS. LUND: Yes.

10 MR. MARKLEY: I'm Mike Markley. I'm Chief
11 of Plant Licensing Branch for the DORL, the Division
12 of Operating Reactor Licensing.

13 MR. WANG: I am Alan Wang. I am the
14 project manager for Grand Gulf Nuclear Station.

15 MEMBER SHACK: You have a nice sign up
16 front.

17 MR. WANG: Oh, I am not sure how to change
18 the slides.

19 CHAIR REMPE: Use an arrow key.

20 MR. WANG: Oh, okay.

21 CHAIR REMPE: You've got it.

22 MR. WANG: The staff will be making
23 presentations on the following topics: transient and
24 accident analysis, long-term stability, spent fuel
25 pool criticality, the Power Range Neutron Monitoring

1 System was just implemented this outage, the
2 mechanical impacts of EPU, the effects of mechanical
3 impacts of EPU, and the steam dryer review, which is
4 closed. In addition, as requested, the staff will
5 make presentations on thermal conductivity degradation
6 and the effects of the EPU on the SBO.

7 The licensee will make an additional
8 presentation, as requested, on the groundwater
9 monitoring system, based on the recent tritium, higher
10 than expected tritium activity found at the site.

11 So as a result of our review, we have
12 required Entergy to add two additional license
13 conditions. One was regarding spent fuel pool
14 criticality. That analysis we found was inadequate
15 and we did not have the time to complete it. As such,
16 Entergy agreed to and has submitted a separate
17 amendment that is being under review right now. And
18 in the interim, the license condition will allow them
19 to load specific loading pattern for the loading of
20 the spent fuel. And Kent Wood will make a
21 presentation on that.

22 CHAIR REMPE: Just out of curiosity, what
23 is the status? Because I have seen different -- the
24 documents we have received have been obtained at
25 different times. Have they completed their submittal?

1 MR. WANG: No, they have not. The
2 submittal has been made. They have said in the
3 analysis it is with Oak Ridge right now. And I
4 understand they are preparing RAIs. And Kent probably
5 could give you a better idea what the status is.

6 CHAIR REMPE: Okay.

7 MEMBER SKILLMAN: And Alan, will Kent
8 describe the inadequacy that you just mentioned?

9 MR. WANG: Yes, he will.

10 MEMBER SKILLMAN: Thank you.

11 MR. WANG: The steam dryer review is a
12 closed session and the original intent -- well the
13 original proposal by the licensee was to reference the
14 ESBWR review and approval of the PBLE methodology, due
15 to the fact that NRO has reopened that review, the
16 licensee changed their approach. And as Louise
17 mentioned, that is what extended the review. Entergy
18 and the staff is no longer referencing the ESBWR
19 review and we did a plant-specific review of the PBLE
20 methodology for Grand Gulf.

21 The biggest thing in that license
22 condition as the request for power ascension test
23 program plant and that is what they submitted. And
24 there were also additional contingents on power
25 ascension and that license condition. And that will

1 be discussed further in the closed session.

2 In general, we felt that the licensee met
3 the guidance in the RIS, the constant pressure power,
4 the licensee topical report and the two GE topical
5 reports on the power uprates.

6 So if you don't have any other questions,
7 I will turn it over to Entergy.

8 CHAIR REMPE: Any questions? Thank you.

9 MR. PERITO: Good morning. I'm Mike
10 Perito, the Site Vice President at Grand Gulf. On
11 behalf of all of us here today, the staff at Grand
12 Gulf and Entergy, I want to thank the subcommittee for
13 the opportunity to discuss the Grand Gulf extended
14 power uprate in support of your review of the license
15 amendment request.

16 Grand Gulf is a BWR 6 with a Mark III
17 containment, with an operational history that is as
18 shown on this slide here.

19 The extended power uprate modification is
20 being implemented now during refueling outage number
21 18 is significant for several reasons. This uprate
22 has been identified as the least cost source of
23 electricity for our customers in Mississippi and will
24 provide additional safe reform for capacity for the
25 region and a challenging economy. And also this

1 uprate is a significant investment in the Grand Gulf
2 people in the plant. Many modifications, including
3 major component replacements highlight our commitment
4 to the long-term safe and reliable operation of Grand
5 Gulf.

6 We have had the benefit of an extended
7 power uprate organization that has been staffed with
8 literally hundreds of person years of specific Grand
9 Gulf experience involved in the planning, design,
10 procurement and construction of this project.

11 To start this process, the site
12 organization has been integrated with the extended
13 power uprate organization and is fully prepared to
14 safely operate and maintain an uprated Grand Gulf
15 Station.

16 I would just like to take one moment and
17 introduce Joe Kowalewski in the first row there, our
18 Senior Vice President and Chief Operating Officer of
19 Entergy operations. And at this point, I would like
20 to turn it over to Mike Krupa, the EPU Project
21 Director to provide you with an overview of the
22 project and modifications.

23 MR. KRUPA: Thanks, Mike. Okay, as Mike
24 said I am Mike Krupa, the Project Manager, Director
25 for the implementation of the Grand Gulf power uprate.

1 It is a little bit redundant but the application was
2 based on the ELTRs for the GE BWR EPU and the RIS, as
3 Alan mentioned. It is a constant-pressure power
4 uprate and we will cover the parameters on the next
5 slide. But the 15 percent increase was just an
6 optimization between the fuel and core design and the
7 mods that we would have to accommodate to uprate. So
8 it was a good, both economical and design margins
9 optimization for the plant.

10 CONSULTANT WALLIS: Can I ask you about
11 the about? That means that --

12 MR. KRUPA: Sorry?

13 CONSULTANT WALLIS: Can I ask you about
14 that?

15 MR. KRUPA: Okay.

16 CONSULTANT WALLIS: That means that you
17 are not limited by approaching some regulatory limit
18 in any way.

19 MR. KRUPA: The FDR would have given us
20 margin to go to a 20 percent uprate, as other plants
21 have but you know, economically, a core design plant
22 mods, there is an optimization that --

23 CONSULTANT WALLIS: I understand.

24 MR. KRUPA: Yes.

25 CONSULTANT WALLIS: Just to clarify that.

1 MEMBER SKILLMAN: Mike is there a weak,
2 weakest link in all of the mods that you have made in
3 all of the changes that you have taken, is there one
4 that stands out in your mind as this is the one we
5 must be most careful with?

6 MR. KRUPA: That is a tough question. We
7 are going to go through the modifications. You know,
8 as we went through and Thomas will talk a little bit
9 about it, we used a margin management process to
10 assure as we evaluated each system that we had
11 adequate or we added margin and thus, implemented
12 these modifications. You know, I hadn't thought about
13 what is the weakest link or the lowest margin I guess
14 is what you are really asking.

15 MEMBER SKILLMAN: This is not a trick
16 question.

17 MR. KRUPA: No, I know.

18 MEMBER SKILLMAN: And I don't have an
19 agenda in asking this. I am just curious.

20 MR. KRUPA: I just have never thought of
21 it.

22 MEMBER SKILLMAN: I have been through
23 these a number of times. And each time you go through
24 one of these, you say you know what, that is where we
25 have got to be careful. Right over there.

1 MR. KRUPA: Well I will give you just a--
2 my concern and I will talk about it at the end of my
3 presentation is during the power ascension testing the
4 integrated controls that we have a good stable
5 controlled power ascension and assure that all of the
6 mods have been implemented per the design and function
7 as designed. And then the design established that we
8 have adequate margin for uprating the plant there.

9 So I will talk a little bit about the
10 power ascension program and the integration of the
11 control systems as we move through them.

12 MEMBER SKILLMAN: Thank you, Mike. Thank
13 you.

14 CHAIR REMPE: Have you started, I mean you
15 are in outage right now. Are you starting to include
16 all these mods at this time?

17 MR. KRUPA: Yes.

18 CHAIR REMPE: And they will all be
19 implemented during this outage?

20 MR. KRUPA: Yes, we started our outage on
21 February 19th and we are in the last week of
22 completion. We are wrapping up the outage doing
23 lineups, final tests before we start going back up.

24 So all the mods that I will discuss have
25 been implemented and we are in the final stages of

1 closing the paper, final testing.

2 So again, constant pressure power uprate
3 you see a 510 megawatts thermal increase in power.
4 The pressure, feedwater temperatures remain the same.
5 The numbers on the slide show a 13 percent increase in
6 feed flow, main steam flow. It is 50 percent over
7 original license power but we have an MUR so it is a
8 13 percent increase over we are currently licensed.

9 The core flow remains -- the max core flow
10 remains the same. You will note that the lower end of
11 that core flow is reduced, based on stability. And we
12 will talk more about that. We have a slide to go
13 through our core operating parameters later in the
14 presentation.

15 Okay. As an overview, because it is a
16 significant set of modifications, I just wanted to
17 take a few minutes to cover the scale, the
18 modifications we implemented. There was over 30
19 discrete mods that we did. They range from set point
20 and scaling adjustments that would be obvious for
21 changes in feed flow and steam flow to replacement of
22 major components like the generator and the steam
23 dryer. It was over two million man-hours of craft
24 labor to implement these mods.

25 About a third of these mods addressed

1 systems important to safety. You know, increase in
2 cooling water capacities or plant reliability or just
3 margins to accidents. And I will just walk through
4 some of them.

5 The Power Range Neutron Monitoring System
6 is the digital replacement for the neutron monitoring
7 system that we have in the plants currently analogue.
8 It provides higher reliability, built-in redundancy
9 and self-checking. It provides for faster response
10 time and automatic detection of instability and then
11 a reactor scram as a result.

12 This PRNMS submittal was a separate
13 license submittal but the stability solution is
14 required for the power upgrade and the core design
15 that we'll be going to. We changed the standby liquid
16 control system enrichment. We have put an enriched
17 boron-10. We increased that by 20 percent. That age
18 and the accident analysis for ATWS particularly.

19 In the ultimate heat sink, again Gulf uses
20 two standby service water basins cooling towers for
21 emergency cooling water. There are 6.6 million
22 gallons each. What we did is change the fill design
23 in the towers to a higher efficiency fill design. It
24 added about a 15 percent improvement in cooling heat
25 exchange and we also added a transfer mechanism that

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1 allowed an increased volume of water to be transferred
2 from one tower to the other in an accident so that
3 that total volume of water is available to either 100
4 percent redundant ECCS divisions.

5 MEMBER SKILLMAN: Mike, are we going to
6 get a chance to talk about some of the specifics of
7 these later?

8 MR. KRUPA: Yes. I'm sorry. The PRNMS we
9 are going to present in detail. The steam dryer we
10 are going to talk about in detail. Let's see --

11 CHAIR REMPE: Is there one item in
12 particular that you have in mind?

13 MEMBER SKILLMAN: Two things. Enriched
14 boron, how do you segregate old boron from new boron
15 so that you don't mix and match?

16 MR. KRUPA: You said how did we implement
17 the mod?

18 MEMBER SKILLMAN: Well I understand what
19 you said is you are going to enriched boron.

20 MR. KRUPA: Yes, we drained the boron
21 system, cleaned the tank, and then we bought enriched
22 boron-10, which is 96 percent boron-10 in the mixture
23 that we put into the tank now.

24 MEMBER SKILLMAN: Is all the old boron
25 gone?

1 MR. KRUPA: It is gone. Yes, drained,
2 cleaned.

3 MEMBER SKILLMAN: You had just changed the
4 fill to stainless steel.

5 MR. KRUPA: That is correct.

6 MEMBER SKILLMAN: What fouling?

7 MR. KRUPA: It is high efficiency, low-
8 fouling fill. But we will continue to monitor the
9 tower performance.

10 MEMBER SKILLMAN: Thank you.

11 MR. KRUPA: Okay, spent fuel pool cooling.
12 Again, we have higher batch off-loads and higher heat
13 loads in those batches. We increased the fuel pool,
14 we changed the fuel pool cool and heat exchangers. We
15 added a 29 percent increased capacity for heat
16 removal. There was a number of mods associated with
17 that but the basic mod has increased to capacity the
18 pool.

19 The heat load increase was about 18
20 percent so we have added quite an additional margin.

21 The steam dryer, again we are going to
22 talk at length about the steam dryer, both us and the
23 staff. But we did opt early in the project to replace
24 the steam dryer and to use the, we have a prototype
25 steam dryer at an EPU plant that has already been

1 instrumented and in service.

2 CONSULTANT WALLIS: Can I ask you about
3 that? Now the stand pipes on the steam line are
4 sometimes problematic. You have to worry about them.
5 Did you do anything to change those valves or those
6 stand pipes to make them less problematic?

7 MR. KRUPA: No, we did not change ours.
8 And we will talk more about that when we get there.
9 We will talk about the frequencies and the resonance
10 that we have.

11 We did instrument our steam lines two
12 cycles ago, as a preliminary for input for power
13 uprate.

14 CONSULTANT WALLIS: It would be nice if
15 you could do something so you didn't have to do all
16 that analysis about frequencies and resonances and how
17 many could resonate and all that stuff but you didn't
18 do that.

19 MR. KRUPA: We didn't change our stand
20 pipes, no.

21 CONSULTANT WALLIS: Okay.

22 MR. KRUPA: But we will talk more about
23 that.

24 Again, the dryer design was enhanced from
25 the prototype to remove the high stress or locate or

1 improve the design of the high stress locations. We
2 improved the thickness of members to lower stress of
3 the members, overall increased this dryer by 40
4 percent in weight. But again, we have quite a few
5 slides to talk about the details of the dryer and the
6 right people here to get into much more detail there
7 for you.

8 Okay, so on the power generation side, we
9 did improve the, we have added a full flow filtration
10 system for the condensate system that will remove --
11 mainly to address the iron. And the margin there is
12 for crud-induced fuel failures. So we are removing
13 the iron from the plant.

14 Our plant service water for normal
15 operation and shutdown operation is a well system.
16 And we have added an additional well, another 10,000
17 gallons' capacity in margin. Again, it is just
18 margin. We don't need them in service.

19 MEMBER SKILLMAN: Mike, would you just
20 briefly describe what a radial well is, please?

21 MR. KRUPA: Yes. The radial well system
22 is a, it is a caisson that is 125 - 150 feet deep into
23 the aquifer. And then in the bottom that, you
24 radially push out your drain pipes that developed
25 aquifer. So it is a well system and it is radial

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1 because the aquifer pipes are radially disbursed
2 around it.

3 MEMBER SKILLMAN: So for your radial --
4 for your new well, you actually take some power from
5 your batteries.

6 MR. KRUPA: I'm sorry?

7 MEMBER SKILLMAN: You take some power from
8 your batteries.

9 MR. KRUPA: No, sir. Did you say power
10 from my batteries?

11 MEMBER SKILLMAN: Yes.

12 MR. KRUPA: No. Well, it is non-safety
13 related.

14 MEMBER SKILLMAN: Okay.

15 MR. KRUPA: It is plant service water is
16 non-safety related. The ultimate heat sink I
17 discussed was the safety-related.

18 This power uprate is adding no new loads
19 to our batteries.

20 MEMBER SKILLMAN: That's not what the
21 Safety Evaluation says. It says it takes some power
22 form the 125-volt non-safety related small change.

23 MR. KRUPA: Okay. Non-safety related.
24 I'm sorry.

25 MEMBER SKILLMAN: Okay. I understand.

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1 Thank you.

2 MR. KRUPA: I misunderstood your question.
3 I'm sorry.

4 MEMBER SKILLMAN: Thank you.

5 MEMBER ARMIJO: Just a quick question
6 about your condenser. Do you have a titanium
7 condenser tubes or do you have copper-bearing?

8 MR. KRUPA: Not copper but I don't know
9 the material.

10 MEMBER ARMIJO: No, copper-bearing. I
11 know it is not copper.

12 MR. KRUPA: No, copper-bearing, yes.

13 MR. SMITH: I'm Fred Smith. What was the
14 question?

15 MEMBER ARMIJO: Do you have a titanium
16 condenser? You talked about crud-induced corrosion
17 and your control of iron. I just wondered if you had
18 done anything about your condenser to remove the
19 cooper.

20 MR. SMITH: We don't have a brass
21 condenser at Grand Gulf. And so our crud depositions
22 are primarily hematite.

23 MEMBER ARMIJO: Yes. What is the material
24 that you use?

25 MR. KRUPA: Let me get back. We can find

1 it but we did evaluate that and we have a -- the
2 analysis was our condenser tubes are fine. And I will
3 get you the materials.

4 MEMBER ARMIJO: Yes, well I am talking
5 specifically about the old crud-induced localized
6 corrosion problem.

7 MR. KRUPA: Yes, not a problem at Grand
8 Gulf.

9 MEMBER SCHULTZ: So there will be more
10 detail there later?

11 MR. KRUPA: Yes, we will bring that back.

12 MEMBER SCHULTZ: You don't have the
13 typical problems but you did move forward to remove
14 the iron?

15 MR. KRUPA: That's right. This plant was
16 demin condensate plant. During startup we have a 30
17 percent capacity to pre-filter the iron. But when the
18 plant is up and running there is no filtration. It is
19 just a demin-based plant. And so all the crud is
20 pumped forward.

21 MEMBER SCHULTZ: Currently? And the
22 modifications have been made?

23 MR. KRUPA: The mods have been made now
24 for full flow filtration. So now they are in the
25 condensate stream 100 percent flow will go through the

1 filters.

2 MEMBER SCHULTZ: I understand. Thank you.

3 MR. KRUPA: Okay, the other power
4 generation mods included replacing the moisture
5 separator re-heaters, nine of our low-pressure
6 feedwater heaters. Both reactor feed pumps, Grand
7 Gulf's feed pumps are turbine driven, steam turbine-
8 driven feed pumps, there is two. We replaced the
9 steam side and casings of both of those feed pumps.

10 CONSULTANT WALLIS: Do you have much
11 material erosion in the heater piping?

12 MR. KRUPA: In the heater piping?

13 CONSULTANT WALLIS: Isn't this one area
14 where you got some of the erosion that CHECWORKS was
15 supposed to take care of?

16 MR. KRUPA: Yes.

17 CONSULTANT WALLIS: Did you actually check
18 how much you had when you took them on?

19 MR. THORNTON: Yes. My name is Thomas
20 Thornton. I am the Engineering Manager for Extended
21 Power Uprate at Grand Gulf.

22 We have looked our FAC program and
23 reviewed those. We had some areas of increase in wear
24 but did not find that we had a significant impact in
25 any of those areas. In our FAC program, we will still

1 be able to monitor those pipes. We did not identify
2 any locations that required --

3 CONSULTANT WALLIS: Nothing unusual.

4 MR. THORNTON: -- upgrades with materials
5 as a result of the extended power uprate alone.

6 MR. KRUPA: What we did as we replaced the
7 feedwater heaters, we replaced some extraction pipe
8 associated with that. And when we did, we upgraded it
9 with chrome-moly. The same with our MSRs. When we
10 replaced those, we went ahead and replaced all the
11 drains with chrome-moly.

12 So we have improved the plant from a FAC
13 point of view as we have done this upgrade. So it
14 improves that going forward.

15 MEMBER SHACK: Just in the normal course
16 of business have you done much replacement because of
17 FAC problems?

18 MR. KRUPA: Not major. Not major.

19 There has been lines with pitting and FAC
20 in the past that we have had to replace but it's
21 nothing major.

22 MEMBER SHACK: But you haven't done major
23 piping replacements.

24 MR. KRUPA: Correct.

25 MEMBER SHACK: It has nothing to do with

1 the EPU either. I was looking at GSI-189 the other
2 day. What did you do to address your igniter problem?

3 MR. KRUPA: My who?

4 MEMBER SHACK: The igniter -- the backup
5 power for the igniters on your GSI-189.

6 MR. KRUPA: I'm sorry.

7 MR. FORD: My name is Brian Ford. I am
8 the Senior Licensing Manager for Entergy. And I just
9 happened to be looking at the igniter issue the other
10 day.

11 For GSI-191, the BWR-6 is --

12 MEMBER SHACK: No, 189.

13 MR. FORD: Oh, 189. Sorry.

14 MEMBER SHACK: Yes, 191 is on all our
15 minds.

16 (Laughter.)

17 MR. FORD: I'm sorry.

18 MEMBER SHACK: Of all other GSIs.

19 MR. FORD: The BWR-6s did two things.
20 One, they made a cross-connect between the Division 3
21 HPCS diesel generators so that they could power the
22 igniters if they had a loss of Divisions 1 and 2.
23 They also put in a connection point where they could
24 connect up a temporary diesel generator. So we have
25 an alternate power supply that can feed that. And we

1 are looking at addressing that as part -- eventually
2 addressing that as part of order EA-12-049 also.

3 MEMBER SHACK: Okay, but that has already
4 been implemented. This is not something we are --

5 MR. FORD: The first ones, yes.

6 MEMBER SHACK: The first ones.

7 MR. KRUPA: The methodology, too.

8 Okay, I think I was working my way through
9 power generation. We did replace all the main
10 transformers again, aging and we were at the limit for
11 the existing transformers. So we went ahead and added
12 new transformers for margin. We replaced the main
13 generator with a refurbished stater and a rewound
14 rotor. We have increased the cooling capacity within
15 the stater with new coolers for hydrogen. We have
16 added a new seal oil system that allows us to increase
17 the hydrogen pressure in the generator to 75 pounds,
18 again for heat removal capability.

19 We have replaced the isophase bus duct
20 coolers with upgraded coolers for the new heat loads.
21 And then to address power ascension, we have added the
22 vibration monitoring requirements to the condensate
23 and steam system.

24 Associated with the dryer, we have got the
25 dryer now fully instrumented and then of course the

1 strain gauges on the steam line to provide that
2 feedback.

3 MEMBER SHACK: How long will that
4 instrumentation last, the steam dryer?

5 MR. KRUPA: That is one of our questions.
6 I guess there is some experience that will make it six
7 months and some that will make it to the next cycle or
8 longer.

9 MEMBER SHACK: Okay. And then there is --

10 MR. KRUPA: I think there are some that
11 are more robust, accelerometers.

12 MEMBER SHACK: There is no intent to make
13 this a really serious kind of instrumentation that
14 would last a long time.

15 MR. VERROCHI: Right. My name is Steve
16 Verrochi. I am the General Manager of Engineering.
17 And I have been involved in the steam dryer from the
18 beginning. We have done some surveys in the industry.
19 As a matter of fact, Jerry has done that personally.
20 And it has been various experiences as far as the
21 instrumentation and how long it will last.

22 General Electric essentially says that any
23 time after six weeks of operation we could start to
24 see instruments fail. The most likely the instruments
25 that would fail would be the strain gauges because

1 they are the most delicate instruments and then the
2 pressure transmitters and accelerometers are more
3 robust and are expected to last longer.

4 The failures that have occurred at other
5 sites that we have talked to range from instruments to
6 actual cabling or --

7 MEMBER SHACK: Yes, that's what I was sort
8 of wondering. Is the wiring set up so that it is
9 going to be destroyed in the normal course of business
10 in a short time? Is it just going to -- how long the
11 instruments last.

12 MR. VERROCHI: Right. It is primarily the
13 instruments and the connection to the wiring that is
14 on the dryer itself. So it is in a very turbulent
15 environment. So you know, those wiring connections
16 can only be so robust because of the delicacy of the
17 instruments. So that is most likely where they will
18 be challenged.

19 We expect to get full use of those
20 instruments through our re-benchmarking market at the
21 current 100 percent power. So we will have the full
22 value of those instruments and the re-benchmarking of
23 our analysis at that point. So we will have that full
24 benefit and then we expect to use those instruments as
25 we proceed in power beyond that. We would expect to

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1 lose some but we also have full redundancy of those
2 instruments. We have 28 instruments. We only need 14
3 to get a full benchmark. And even if we lose some of
4 those 14, they will still be adding valuable
5 information as we go.

6 So it is not like it is all or nothing.
7 We will be able to use those instruments all the way
8 through power ascension.

9 MEMBER SIEBER: The only time you need it
10 is to complete the startup testing.

11 MR. VERROCHI: That's correct. The only
12 time we need it is to complete the startup testing.
13 Right. That is a very good point, sir.

14 MEMBER SIEBER: So it could start to pay
15 off the next day.

16 MR. VERROCHI: Right. We actually remove
17 these instruments the next outage where we have to
18 remove these instruments, remove all the cabling. So
19 it is only intended to be on the dryer for one second.
20 That is correct.

21 MR. KRUPA: Now there is two sets of
22 instruments we are talking about. One is the onboard
23 on the dryer instrumentation and then the plant
24 startup instrumentation on the condensate steam lines
25 for vibration monitoring. And those are almost I

1 think all entirely accelerometers and should last the
2 cycle but we only need them for the power ascension
3 testing and benchmarking.

4 I have added some pictures for you. The
5 moisture separator re-heaters, the construction of the
6 well, the transformer replacement, aux tower. But the
7 feedwater heaters, there is our new dryer.

8 CONSULTANT WALLIS: Can I ask you about
9 these main transformers? This is the way they
10 actually look in slide nine out there in the field
11 like that?

12 MR. THORNTON: Those units are staged
13 currently prior to the installation. They are single-
14 phase units.

15 CONSULTANT WALLIS: So they sit out there
16 and the water just comes into them?

17 MR. KRUPA: No, no. These are just being
18 delivered.

19 CONSULTANT WALLIS: That's just been
20 delivered. I just wondered what they are doing there.
21 They are just sitting there.

22 MEMBER SIEBER: It looks like they don't
23 have coolers.

24 CONSULTANT WALLIS: There is nothing
25 there.

1 MEMBER SKILLMAN: This is the new
2 technology.

3 (Laughter.)

4 MEMBER SHACK: They have a wireless
5 network.

6 MEMBER SIEBER: Each has its own
7 transformer?

8 MR. KRUPA: That's correct. We have three
9 main transformers with a built-in spare.

10 MR. THORNTON: But we have an installed
11 spare as well.

12 MR. KRUPA: Okay. Again, the summary for
13 modifications. This slide shows the modifications we
14 made that specifically address the safety and
15 transient risk margins that we have made to the plant.
16 I think I have discussed all of these.

17 And the next slide is just again a summary
18 for the reliability and operating margins that we
19 performed.

20 All right, now for power ascension
21 testing, again the plan picks up where we are wrapping
22 up with our modifications, our post-modification
23 testing that we have done in the field to assure the
24 design or the mods were implemented and function per
25 the design.

1 The power ascension test program will
2 assure a controlled ascension and integration testing
3 of the mods to the other for plant operation. We did
4 do this in conjunction with the SRP and the LTRs for
5 EPU power ascension testing. The test plan is
6 fashioned after our original power ascension test when
7 we commissioned the unit.

8 The tests are developed and will be
9 implemented by very experienced Grand Gulf engineers
10 that were involved with the previous test program.

11 MEMBER SKILLMAN: Mike, let me ask this.

12 MR. KRUPA: Yes?

13 MEMBER SKILLMAN: You have invested very
14 significantly in the physical plant. You have
15 refurbished. You have upgraded. You have provided
16 margin. To what extent has that modification
17 mentality carried over into emergency preparedness,
18 emergency planning and the offsite actions that may
19 accompany this 500-megawatt electrical increase?

20 MR. KRUPA: There is a -- one of the mods
21 that was made that was on that first slide was an
22 improved core simulator for the operator training and
23 simulation. So we have upgraded the simulator model
24 for this new thermal hydraulic condition. We have
25 reviewed all of our EP plans. There are some changes

1 in the EP plan but just associated with some of the
2 setpoints or condition monitoring issues for some of
3 the curves for containment or suppression pool
4 temperature.

5 So we had to upgrade our EP plan but there
6 was no real change to the plan.

7 MEMBER SKILLMAN: Thank you.

8 MR. KRUPA: This matrix shows the power
9 ascension program and the group test that we will be
10 performing. We will start baseline vibration
11 monitoring and steam dryer monitoring at 50 and 75
12 percent power. And you know the radiochemical and
13 radiological conditions around the plant will all be
14 monitored through the whole power ascension as a
15 monitoring program.

16 The significant I will say dynamic testing
17 or transient testing that we will be doing is in the
18 area of pressure regulator dynamic tuning and the
19 feedwater dynamic tuning. With pressure regulators
20 starting at 90 percent, we will do step changes with
21 the pressure regulator up and down with magnitudes of
22 about six pounds to show that the pressure regulation
23 with the new turbine and the control valves are the
24 same but the pressure regulation with the reactor,
25 those powers is stable.

1 The same with feedwater system, we will do
2 step changes of two and four inches up and down. We
3 will use, take one feed pump to manual and make step
4 changes with it and make sure the other one follows.

5 And as we go through this, the power
6 ascension test is established in plateaus of two and
7 a half percent, very controlled plateaus where we will
8 stop, do these tests, assess the data. At the five
9 percent plateaus, the data analysis for the dryer will
10 be submitted to the NRC staff for their review and we
11 have, in our license condition, hold points at those
12 times for the staff's review and concurrence with
13 moving forward. So, a very controlled two and a half
14 percent increase in power. It is probably over six to
15 eight weeks it will take to bring the unit to new
16 thermal power.

17 The power ascension program acceptance
18 criteria is established with Level 1 and Level 2.

19 CONSULTANT WALLIS: We are going to get to
20 the steam dryer but just can I ask you? Are you
21 instrumenting those stand pipes?

22 MR. KRUPA: Yes.

23 CONSULTANT WALLIS: You are instrumenting
24 those for resonance?

25 MR. THORNTON: We are instrumenting, yes,

1 the safety relief valves will be instrumented to
2 determine if there are vibrations on there.

3 CONSULTANT WALLIS: It is just vibration.
4 Are not monitoring pressure fluctuations or just
5 vibration?

6 MR. THORNTON: They will be transduced on
7 the main steam lines as well for pressure.

8 CONSULTANT WALLIS: Okay, but you won't
9 separately monitor the stand pipes for pressure?

10 MR. THORNTON: Not independent of the --

11 CONSULTANT WALLIS: So if that spraying
12 like an organ pipe, you won't know it, except by
13 vibration?

14 MR. KRUPA: Absolutely we will.

15 CONSULTANT WALLIS: By vibration.

16 MR. THORNTON: Yes. I mean, we fell like
17 the monitoring will make complete coverage of all the
18 SRVs and we will understand what is going on there.

19 CONSULTANT WALLIS: Well we will get to
20 that, I guess later.

21 MR. THORNTON: We will discuss that in
22 more detail when we cover that topic a bit later.

23 MR. KRUPA: Okay, again I know you have
24 heard Level 1 and Level 2 acceptance criteria for
25 testing. The Level 1 associated with the plant safety

1 analysis. And if we hit a Level 1 criterion and it is
2 not met, we will put the plant back in a safe
3 condition while that is evaluated and a corrective
4 action program and corrected before we move on. We
5 would have to redo that test after correction and pass
6 the Level 1 criteria before moving on.

7 Level 1 criteria is, for the example I
8 used, for regulation, pressure regulation or feed
9 regulation is no divergence in the control system. In
10 the example on the slide, feedwater run out capacity
11 can't exceed the value in the accident analysis, so
12 that we don't overfeed the vessel and create a thermal
13 limits problem for the fuel. So the feed pumps can't
14 put out more water than the design analysis.

15 MEMBER SKILLMAN: Before you change, how
16 robust and healthy is your corrective action program,
17 please?

18 MR. KRUPA: I think we have a real solid
19 corrective action program. You know, I think our
20 threshold level is very low. Our Corrective Action
21 Review Group is the senior plant management of the
22 site. The plant general manager chairs that committee
23 and reviews every corrective action written and
24 evaluates what threshold and what degree of
25 disposition and corrective action occurs. We have, it

1 is a structured level from a root cause to an apparent
2 cause to a corrective action.

3 MEMBER SKILLMAN: Are your root causes
4 effective?

5 MR. KRUPA: I believe they are. And we do
6 assessments in an 18-month cycle type of frequency
7 between ourselves or independent organizations come in
8 an assess the effectiveness of the corrective action
9 program, besides the staff and the annual inspections.

10 MEMBER SKILLMAN: Thank you, Mike.

11 MR. KRUPA: Yes, I think we have a very
12 robust program.

13 MEMBER SKILLMAN: Thank you.

14 MEMBER SCHULTZ: Mike, as you have gone
15 through this process in making changes in preparing
16 for this outage, has the volume of activity associated
17 with a corrective action program increased?

18 MR. KRUPA: Absolutely. You know, the
19 scale of the modifications and the amount of work that
20 was put in the last let's say year, and it has really
21 been longer since we have been working on the project
22 but this has brought up a lot of new issues or more
23 issues in volume than the station normally deals with
24 just operations. You know, anything from construction
25 issues to a plant design question that you come up

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1 with while you are going through something like this.
2 So yes, the volume is up. We are close to 8,000.

3 MR. PERITO: Eight thousand, which is
4 typically what we generate over the course of a year.

5 MR. KRUPA: Yes.

6 COURT REPORTER: Speak into a mike.

7 CHAIR REMPE: And identify yourself,
8 please.

9 MR. PERITO: I'm sorry. I'm Mike Perito
10 again, the Site Vice President. We are around 8,000
11 is the total number of condition reports generated
12 this year. Typically at Grand Gulf and across the
13 fleet, that is about the number you get in 12-month
14 cycle. So significant input to the corrective action
15 program.

16 MEMBER SCHULTZ: And has this then created
17 a higher backlog? And if so, what is the plan to
18 address that in the station?

19 MR. PERITO: From a big picture
20 perspective, we track all those backlog numbers and
21 the time to disposition corrective action requests,
22 whether they are the broke-fix type or whether we do
23 causal analysis on them. So we have indicators that
24 monitor that. And our threshold is a 30-day
25 turnaround for the more detailed causal analysis than

1 we need that indicator.

2 MR. VERROCHI: This is Steve Verrochi, the
3 general manager of engineering. From an engineering
4 point of view, we track the backlog of corrective
5 actions very closely. And our goal across the fleet,
6 the Entergy fleet is 150 CRs. We are currently, at
7 Grand Gulf, we are at about 215. We are well within
8 you know, we are staffed sufficiently to be able to
9 respond to these, get a good response and a timely
10 response to keep ahead of the workload that is coming
11 in.

12 So we feel that we are doing a very good
13 job at keeping the backlog in the range it needs to be
14 as we come out of this outage.

15 MEMBER SCHULTZ: Thank you.

16 MR. KRUPA: Okay. Again, the Level 2
17 acceptance criteria associated with the design
18 parameters and performance they again would be any
19 Level 2 criterion we didn't meet would be put into the
20 corrective action program for immediate disposition
21 and appropriate correction.

22 Level 2 criteria in the example I used
23 with regulator flows, feed flow or pressure regulator
24 would be quarter dampening for Level 2. You know, no
25 divergence for Level 1 and quarter dampening would be

1 Level 2 criteria.

2 In the case of the feedwater flow
3 capability that we have at least five percent margin
4 at normal operating power on the feed pumps.

5 So that is my prepared remarks for both
6 the mods and our power ascension program.

7 MR. VERROCHI: I wanted to respond to an
8 earlier question. I know Sam asked it, so if you
9 could make sure he gets the message. Our condenser
10 tubes are 304 stainless steel --

11 CHAIR REMPE: Okay, I will tell him.

12 MR. VERROCHI: -- with very good
13 performance to date. And they do not add to any
14 contamination levels in the condensates.

15 Our primary focus with the full flow
16 filtration was iron content in the overall system.
17 And that is going to be a big addition for Grand Gulf.

18 MEMBER SCHULTZ: How does that compare,
19 that system? Is this same system in use in other BWRs
20 in the Entergy fleet?

21 MR. VERROCHI: Yes, we have the same
22 system installed in our Riverbend Station and have had
23 very good success with that. We are able -- INPO has
24 limits -- INPO as well as EPRI has limits that are
25 monitored very closely for iron content. And we saw

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1 a drastic change when we installed this system at
2 Riverbend. We saw a drastic improvement in iron
3 content and overall chemistry numbers. So we expect
4 to see the same at Grand Gulf in this system.

5 MEMBER SCHULTZ: Thank you.

6 MEMBER SIEBER: Do you have any excessive
7 amount of salt in your circulating water?

8 MR. KRUPA: No. No, it is well water and
9 so it is not salt.

10 MEMBER SIEBER: Okay.

11 CHAIR REMPE: Are there any more
12 questions? Well, we were scheduled to a break at
13 10:00 and then reconvene with the safety analysis and
14 other topics. Do you want to go ahead and keep going
15 and maybe we will look at around 10:00 to take a break
16 then.

17 MR. KRUPA: Yes, so we will introduce Greg
18 Broadbent.

19 MR. BROADBENT: I am Greg Broadbent. I'm
20 the Supervisor of Safety Analysis for EPU Safety
21 Analyses and I am here to talk about the EPU Safety
22 Analyses.

23 Basically we used, as Mike had pointed
24 out, the GE topical reports to determine what we need
25 to review for the safety analysis. We looked at the

1 reload analysis. We developed a EPU equilibrium core
2 and ran a number of different reload analyses on that,
3 developed operating limits. We -- going down through
4 those events, those are the limiting reload events.

5 The only one where we found that we did
6 not have the margin that we would have liked was for
7 the SLC shutdown margin. We met the criteria with our
8 standby liquid control system but there was not enough
9 margin there for us to feel comfortable for cycle-to-
10 cycle variations. So we decided, as Mike had pointed
11 out, we did do the SLC modification and we introduced
12 enriched boron into that system.

13 MEMBER SKILLMAN: Was the limitation on
14 the volumetric flow rate or just on the reduction K-
15 effective with a higher boron concentration?

16 MR. BROADBENT: It is the reduction in K-
17 effective.

18 MEMBER SKILLMAN: I understand. Thank
19 you.

20 MR. BROADBENT: And we went to 96 percent
21 enriched boron. And to answer a previous question to
22 yours, we do have a test, a tech spec that does check
23 the boron enrichment in the event every time we add
24 boron to the tank. So if we did add the wrong boron,
25 we would pick it up in the tech spec surveillance.

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1 MEMBER SKILLMAN: Thank you, Greg.

2 MEMBER SCHULTZ: Greg, you mentioned you
3 did the evaluation for an equilibrium core. How did
4 you address the transition?

5 MR. BROADBENT: Well there is a bounding
6 equilibrium core. And that is the GE philosophy.
7 They develop an equilibrium core now. We actually do
8 have a Cycle 19 core design which we are starting up
9 on. So we do see some transition effects. But they
10 are within the range of what we expect with that
11 equilibrium core.

12 MEMBER SCHULTZ: Any surprises or
13 differences that weren't expected? I was thinking of
14 the methodology that was used.

15 MR. THORNTON: I think we are going to
16 cover the core design and the aspects of that. We can
17 cover that in more detail at that time.

18 MEMBER SCHULTZ: Thank you. I can wake.

19 MR. SMITH: Fred Smith, the Manager of
20 Fuel and Analysis. The cycle-specific analysis for
21 GE's analysis is pretty substantial. And so certainly
22 things like SLC are evaluated every cycle.

23 MEMBER SCHULTZ: Understood.

24 MR. SMITH: So the equilibrium core
25 analysis that Greg is doing is establishing a

1 framework that we make sure that we will be successful
2 going forward. And of course, if there is an issue in
3 a cycle-specific analysis, we will have to make some
4 kind of adjustments.

5 MEMBER SCHULTZ: Thank you.

6 MR. BROADBENT: And we saw, in terms of
7 operating limits, we saw basically what we expected in
8 terms of SLC shutdown margin, the cycle-19 core was
9 actually a little hotter than the EPU core. And if we
10 had not done the SLC boron-enrichment mod, we would
11 not have had adequate shutdown margin for this
12 upcoming cycle.

13 MEMBER SCHULTZ: We are going to cover
14 more on core design later, from what I understand?

15 MR. BROADBENT: Yes.

16 MEMBER SCHULTZ: Thank you.

17 MR. BROADBENT: We performed the
18 containment analysis. We ran the main steam line
19 break, recirc line break. We did see an increase in
20 containment pressure and we did see an increase and
21 the allowable, the maximum containment pressure that
22 we based our Appendix J testing on, we ran some
23 special events. I have a slide about Station
24 Blackout, Appendix R and the ATWS analysis.

25 For the ATWS analysis we did make two tech

1 spec changes to support that. And there was a SLC
2 pump relief valve that we increased these tech spec
3 set point on because of the slightly higher pressure
4 and the reactor vessel during an ATWS. And also we
5 added two new SRVs to the tech spec operability
6 requirements. We have got 20 SRVs installed
7 previously. Our tech spec only required 13 to be
8 operable. Now we require 15 to be operable to meet
9 the ATWS over pressurization limits. And I have got
10 some numbers, specific numbers.

11 MEMBER SKILLMAN: Greg, these are the
12 Dijkers valves?

13 MR. BROADBENT: Yes.

14 MEMBER SKILLMAN: Is the combination of
15 the Dijkers valve, the Sempress actuator, and the
16 Seitz solenoid a suite that is commonly used for Bs,
17 for these boiling water reactors? Is this a normal
18 complex of equipment or is this unique to this site?

19 MR. THORNTON: I don't believe they are
20 unique but I don't have the information on how common
21 that setup is. I can get that.

22 MEMBER SKILLMAN: I would like to bring
23 that back, please. My real question comes from the
24 safety evaluation, page 91, where the operating
25 experience for the Dijkers valve, Sempress actuator

1 and Seitz solenoids is acceptable. I would like to
2 know where else these things are used, and what is the
3 experience with these.

4 MR. THORNTON: I understand.

5 MEMBER SKILLMAN: Thank you.

6 MR. BROADBENT: And in terms of
7 radiological events, some of the limiting events that
8 we looked at were the LOCA, the fuel handling accident
9 and the control rod drop. We are an alternative
10 source term plant, full scope alternative source term
11 plant, we were a pilot application back in 2000 and we
12 maintained these in the alternative source term
13 application.

14 Some numbers. For suppression pool, the
15 limiting event for our suppression pool was the
16 station blackout. And like I said, I will talk more
17 about station blackout later on. We have an
18 acceptance limit on the pool of 210 degrees.

19 We do have a lower acceptance criteria for
20 events that generate debris, like the LOCA. And that
21 is based on that positive suction head and the
22 additional DP that is introduced across the strainers.

23 And that limit is 194 and the LOCA was
24 with EPU 189.

25 In terms of drywell temperature, the main

1 steam line break was the limiting event. We actually
2 saw a slight decrease from methods change to 307
3 degrees. In terms of pressure, pressure did go up in
4 the drywell from 22 to 27 psig, the limit as 30 psig.

5 And in the containment, we did see an
6 actual reduction in temperature for the maximum
7 containment event. The reason for this is previous GE
8 methodologies assumed thermal equilibrium between the
9 water and the air and their newer methodologies
10 consider that more of a mechanistic transfer. So
11 therefore, for events for the alternative shutdown
12 cooling, where you are putting the heat into the
13 water, you don't see the air temperature go as high.

14 And for the main steam line break, we did
15 see an increase in the wet well pressurization for the
16 main steam line break. And for the recirc line break,
17 the long-term pressure will set by the recirc line
18 break at 11.9.

19 CONSULTANT WALLIS: Can I ask you now? I
20 asked an earlier question about whether you were
21 approaching some limit. And I was told no you
22 weren't; you could have gone to 20 percent upgrade in
23 power. But it looks as if the pressure from the MSRV
24 is approaching the limit.

25 So if you went to 20 percent, you would

1 probably be over it, if I just extrapolate that.

2 MR. BROADBENT: Well not necessarily
3 because that is a short-term pressure peak driven by
4 the steam release.

5 CONSULTANT WALLIS: Right.

6 MR. BROADBENT: And it is not really a
7 decay heat load impact.

8 CONSULTANT WALLIS: Why does it go up so
9 much? Why does it go up so much?

10 MR. BROADBENT: There were some changes
11 made to the inputs. That event hadn't been reviewed
12 or re-performed since the mid-'80s.

13 CONSULTANT WALLIS: Because you would
14 expect it would be about the same with the short-term.

15 MR. THORNTON: Well there is an area of
16 the containment, our containment design the Mark III
17 containment has the suppression pool. And there is an
18 area above the suppression pool that has a floor for
19 the hydraulic control units for the control rod drive
20 mechanisms. It is in that area where we see this peak
21 occur. So the bulk of the containment doesn't see the
22 large pressure increase. And when we look at the
23 long-term effects, the long-term effects are still,
24 only show the smaller increase, less than 12 pounds.

25 CONSULTANT WALLIS: Now I had a bit of a

1 complaint about this because I have read all this huge
2 documentation in the PUSAR and the SER and nowhere is
3 there a diagram.

4 So if you say that a certain region has a
5 higher pressure than another, I have no idea what you
6 mean, unless I dig into something in the past, which
7 I was not willing to do.

8 MR. BROADBENT: We do have a backup slide
9 available on that.

10 CONSULTANT WALLIS: Yes, but that is now.
11 It would help if these documents had some kind of a
12 diagram which showed the crucial elements that you are
13 talking about so I understand what is going on or
14 someone else could understand.

15 MEMBER SIEBER: All these areas reach an
16 equilibrium as things balance out. This is the
17 initial --

18 MR. THORNTON: Correct. And we have
19 continued to look at this as we have done other
20 analysis and currently, the analysis is indicating
21 that the initial analysis was very conservative in the
22 way it modeled the area. In looking much closer than
23 that, we found that there is a larger volume than was
24 initially considered and we are seeing that those
25 numbers are expected to be much lower. So we won't be

1 approaching that limit as shown here.

2 CHAIR REMPE: But it would be nice to have
3 the backup slide showing the location, if you would be
4 willing to provide that.

5 MR. BROADBENT: We can bring that up
6 following the break.

7 MEMBER SKILLMAN: For the SBO event, your
8 suppression pool temperature is above your original
9 185 Fahrenheit limit. If that new limit is 210, I
10 read in the safety evaluation that there has been a
11 thorough analysis of the suppression pool for the
12 higher temperature. Could you make a comment about
13 the thoroughness of that analysis, please?

14 MR. THORNTON: Well yes, I mean we looked
15 at the equipment associated with that, including the
16 piping. We did piping analysis to consider the higher
17 temperature through the piping to ensure that stresses
18 of the piping weren't exceeded. That was probably the
19 biggest impact of the analysis that we had to look at.

20 MR. BROADBENT: And also the containment
21 liner. We looked at the containment liner as well.

22 MEMBER SKILLMAN: Thank you.

23 MEMBER SCHULTZ: Greg, I don't know which
24 way is easiest to answer this question but which of
25 the analysis, the analysis methodologies here were not

1 changed, as you went through the process for the
2 evaluation. We are seeing this comparison between
3 before and after on the uprate analysis but then you
4 mentioned as you have gone through here, some changes
5 in analysis either in input assumptions from one case
6 to the next and some with regard to methodology.

7 MR. BROADBENT: And very rarely were there
8 changes. Most of this is methodology, GE methodology.
9 And I don't know --

10 MR. THORNTON: But there were other
11 analyses that weren't looked at that you don't list
12 here. Can you speak to some of those that didn't show
13 impacts from EPU, I believe is what you are asking.

14 MEMBER SCHULTZ: Yes. I'm trying to get
15 the perspective of the physical changes versus the
16 analysis change.

17 And I would also like to know when you say
18 that the GE analysis was improved and applied here, I
19 am assuming that those analyses improvements were
20 available to you. They weren't created for this
21 particular application.

22 MR. BROADBENT: No.

23 MEMBER SCHULTZ: You didn't struggle to
24 derive the acceptable results but rather you took
25 advantage of technology that has been developed over

1 the past several years. Is that true?

2 MR. BROADBENT: And probably even before
3 the last several years. I mean, we were not using
4 TRACG. We were using the standard SHEX and LAMB codes
5 and all of these lowdown calculations.

6 Grand Gulf had not revisited these
7 calculations for the Appendix K analysis because
8 everything had been done previously at 105 percent, so
9 they didn't need to be looked at. So these haven't
10 been reanalyzed since plant licensing.

11 MR. THORNTON: Yes, I really believe it is
12 these methodologies that have allowed plants to
13 consider extended power uprate and look at the
14 analyses much closer and get more realistic analysis.

15 MEMBER SCHULTZ: Thank you.

16 MR. BROADBENT: And in terms of some of
17 the core parameters, the PCT for the LOCA is less than
18 1690 with a large amount of acceptance -- a large like
19 2200 acceptance limit.

20 Also the peak vessel pressure for the ATWS
21 went up from 1387 to 1455. I will point out that the
22 1455 included two additional SRVs being operable and
23 it did not credit the other five SRVs that are
24 installed. So it is also a very conservative
25 analysis.

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1 MEMBER SKILLMAN: Why did you not credit
2 the other five?

3 MR. BROADBENT: Because for that analysis,
4 we just assumed that we are at our minimum tech spec-
5 required complement of SRVs.

6 MR. THORNTON: We are just maintaining
7 margin really for operating margin. In this because
8 we have had good experience, we don't typically have
9 to have safety relief valves out of service, so it is
10 just margin.

11 MEMBER SKILLMAN: So if those other five
12 function, does that create a different problem for you
13 in terms of DNB or fuel temperature?

14 MR. BROADBENT: No. No, it helps us.
15 Otherwise, we would be analyzing with all 20 if that
16 was the worst case.

17 MEMBER SKILLMAN: Okay, thank you.

18 MEMBER SIEBER: But you are required to
19 analyze that way because your tech specs read that
20 way.

21 MR. BROADBENT: Correct.

22 MEMBER SIEBER: There is no choice.

23 CONSULTANT WALLIS: Well how about long-
24 term cooling? You have got 15 percent more to K-E
25 roughly?

1 MR. BROADBENT: Yes.

2 CONSULTANT WALLIS: I didn't see anything
3 about long-term cooling.

4 MR. BROADBENT: The suppression pool
5 temperature goes up. We eventually have to reject
6 that additional heat. So we do with a higher
7 suppression pool temperature, we do get more heat
8 rejection across the RHR heat exchangers. And as you
9 saw, the pool temperature did go up and that is a
10 result of the decay heat load from a long-term
11 perspective.

12 CONSULTANT WALLIS: I guess the staff is
13 satisfied with it. I just didn't see an analysis of
14 long-term cooling.

15 MR. THORNTON: Well our ultimate heat sink
16 is designed for a 30-day operation.

17 CONSULTANT WALLIS: If you have improved
18 that, you have improved that.

19 MR. BROADBENT: That's right.

20 CONSULTANT WALLIS: Maybe I will ask the
21 staff the same question.

22 MEMBER SCHULTZ: Thomas, with respect to
23 the valve testing and performance, you mentioned you
24 had good performance. And I take it that means that
25 you rarely have valves out of service --

1 MR. THORNTON: Correct.

2 MEMBER SCHULTZ: -- due to testing and
3 awaiting maintenance.

4 MR. THORNTON: I mean, during operation
5 the valves are all in service. The 20 valves, our
6 test results have been real good. You know, we have
7 a samples of tests that we do in the refuel outages.
8 And you know, I have had good success with those test
9 results in proving the valves with those tests.

10 MEMBER SCHULTZ: So you haven't had valves
11 out of service --

12 MR. THORNTON: No.

13 MEMBER SCHULTZ: -- during operation.

14 MR. THORNTON: No. Typically not. I
15 mean, I think the most significant we would have would
16 be a valve weeping with good operation. In the last
17 cycle we haven't seen that for most of the operation.

18 MEMBER SCHULTZ: Thank you.

19 CONSULTANT WALLIS: This temperature with
20 debris, this is based on some methods which go back to
21 original licensing? Evaluate debris now.

22 MR. BROADBENT: Well we put in a new ECCS
23 suction strainer years ago as a resolution at the
24 generic issue.

25 CONSULTANT WALLIS: At that time, the

1 generic issue with boilers.

2 MR. BROADBENT: That's right. So we have
3 a debris load on that strainer that introduces an
4 additional pressure drop, which then affects the net
5 positive suction head and lowers the limit on the
6 maximum pool temperature that we are allowed.

7 CONSULTANT WALLIS: So you are using the
8 methods which were in place some time ago.

9 MR. THORNTON: Yes. This was really a
10 recognition of the margin that we had available to us
11 with a suction strainer design that we have in our
12 suppression pool.

13 CONSULTANT WALLIS: What is it that gets
14 in the strainer? Is it oxides of iron or something?
15 What is it?

16 MR. BROADBENT: It is insulation.

17 CONSULTANT WALLIS: Insulation?

18 MR. BROADBENT: Primarily insulating
19 materials. And besides which, we tried to minimize --

20 CONSULTANT WALLIS: There is some crud in
21 the suppression pool. Do you have to clean that
22 periodically?

23 MR. THORNTON: Yes.

24 CONSULTANT WALLIS: Well maybe boilers
25 will be revisited on this issue, someday? Because 191

1 has been going on for a very long time with the BWRs.

2 MR. THORNTON: And we understand there is
3 BWR Owners' Group effort out there.

4 CONSULTANT WALLIS: So you are following
5 all of that.

6 MR. THORNTON: Yes.

7 CONSULTANT WALLIS: But there is no
8 urgency.

9 MR. THORNTON: That's right.

10 MEMBER SIEBER: But they got it first.

11 CONSULTANT WALLIS: Thank you.

12 MR. VERROCHI: I would like to follow up
13 a little bit more on the long-term cooling. I have
14 Larry King here with me, who is our GE representative
15 and he has been working with the overall analysis
16 work. So I would like to have him just talk to you.

17 MR. KING: The question was long-term
18 cooling. Long-term cooling is evaluated in the
19 analysis, particularly in the suppression pool that is
20 represented if it is a long-term effect. It is also
21 included when they look at the LOCA effect on fuel and
22 maintaining actual core spray and coolant into the
23 reactor. So while not a separate subject, it is
24 included in those analyses.

25 MR. BROADBENT: It is also looked at, for

1 example, in the ultimate heat sink basin inventory and
2 all that. In terms of ECCS net positive suction head,
3 we take no credit for containment accident pressure
4 and we have positive margins to our pump curves.

5 And in terms of station blackout --

6 CONSULTANT WALLIS: The pump curves are
7 conservatively based, are they? They are not based on
8 actually deteriorating but surviving for a limited
9 time. They are based on is it a conservative approach
10 to the pumps? Because there are various curves that
11 you can get depending on how much damage you are
12 willing to tolerate to the pump.

13 MR. THORNTON: Yes, I may need to follow
14 up on that. I'm not aware of any degradation that we
15 can't pour in the pump because I believe we are using
16 standard pump curves but we can confirm that.

17 MR. BROADBENT: We don't accept any post-
18 accident damage to the pump. We are not operating
19 them in a region that is outside of the allowable pump
20 curve.

21 MR. VERROCHI: This is Steve Verrochi
22 again. We do test these pumps regularly to ensure
23 that we have the performance. There is criteria that
24 we test them to. So we are always regularly testing
25 these pumps to ensure that we meet the desire of our

1 clients.

2 MEMBER SIEBER: That's all recorded?

3 MR. VERROCHI: That's all recorded. It is
4 all documented with surveillances.

5 MEMBER SIEBER: What is the periodicity?

6 MR. VERROCHI: The periodicity of the RHR
7 pumps --

8 MEMBER SIEBER: Are they quarterly?

9 MR. VERROCHI: Quarterly, right.

10 CONSULTANT WALLIS: So when you test them,
11 do you go to explore this NPSH limit?

12 MR. VERROCHI: You are testing flow
13 conditions in the current state, which you can
14 correlate to the pump curves. So the pump curves are
15 going to be --

16 MEMBER SIEBER: It's a single point.

17 MR. VERROCHI: Right, it is a single
18 point.

19 MR. THORNTON: They give you your head
20 requirements.

21 MR. VERROCHI: That's correct. So you are
22 verifying where the pump is on this pump curve for
23 that particular flow condition.

24 CONSULTANT WALLIS: So you don't try
25 testing it, for example, at the temperatures you get

1 in the suppression pool during a LOCA?

2 MR. THORNTON: No. The test won't be done
3 at accident conditions.

4 CONSULTANT WALLIS: A method to
5 extrapolate.

6 MR. THORNTON: Yes, via the pump curves.

7 MR. BROADBENT: Okay, with regard to
8 station blackout, our current licensing basis is we
9 use a NUMARC 87-00 methodology for a four-hour AC-
10 independent coping period plant. The impacts of EPU
11 are basically the higher decay heat load associated
12 with EPU. That leads to increased drawdown of our
13 condensate storage tank inventory. We use RCIC to
14 maintain core level post or during a station blackout.

15 Also the safety relief valves open and
16 close to release steam to the suppression pool. There
17 will be more cycles due to the higher heat load but we
18 have enough air accumulator capacity for those
19 additional cycles.

20 Also, as I had pointed out previously, the
21 temperature in the drywell, in the containment, and in
22 the suppression pool all increase due to the EPU, due
23 to the higher --

24 CONSULTANT WALLIS: What about the
25 sticking of these SRVs if they are cycling so much and

1 then taking a high temperature going through them? Do
2 you have some way of evaluating whether or not they
3 stick?

4 MR. THORNTON: Well in our test when we
5 test the valves in the outage, I mean, we look at the
6 operation of the valves to ensure that we are
7 operating properly.

8 CONSULTANT WALLIS: But that is one up.
9 It is not cycling.

10 MR. THORNTON: Right. And the valves have
11 been tested and we have testing that supports the
12 number of cycles that the valve is designed to be
13 capable of.

14 CONSULTANT WALLIS: So you have some
15 evidence to -- They cycle more as a result of EPU.
16 And you have some kind of evidence that that is okay.

17 MR. THORNTON: The design testing of the
18 valves for the number of cycles.

19 CONSULTANT WALLIS: Goes to many more
20 cycles than with EPU?

21 MR. THORNTON: Yes. I mean, we did not
22 exceed the capacity of the valves before that.

23 CONSULTANT WALLIS: For a number of
24 cycles? Can you get some numbers for that?

25 MR. THORNTON: Certainly. Certainly.

1 MR. BROADBENT: You know the numbers are
2 we have got 61 cycles that it goes through for the
3 current license thermal power. For EPU, it is 86.

4 CONSULTANT WALLIS: So it is, okay.

5 MR. BROADBENT: The limit, due to the air
6 capacity, is 200.

7 CONSULTANT WALLIS: That's the air
8 capacity.

9 MR. BROADBENT: Right.

10 CONSULTANT WALLIS: How about just the
11 mechanics of the valve itself and the thermal
12 transients and all that?

13 MEMBER SHACK: The qualification testing.

14 MR. BROADBENT: Right, that is a number I
15 will have to look at.

16 CONSULTANT WALLIS: Could you look into
17 that?

18 MR. BROADBENT: Certainly.

19 MEMBER SKILLMAN: Dr. Wallis is asking the
20 same question I asked about the Dijkers valve, the
21 Sempress actuator, and the Seitz solenoid. So I am
22 just saying, where are these used? What is their
23 history duct? Wallis is saying, tell us about thermal
24 failure performance.

25 MR. BROADBENT: Sure.

1 MEMBER SKILLMAN: That is what each of us
2 is asking, please.

3 MR. BROADBENT: Okay, we will get to you
4 some more information.

5 MEMBER SKILLMAN: Thank you.

6 MR. BROADBENT: And in terms of the EPU
7 results, as I had mentioned for the CST, the
8 compensate storage tank water inventory, it did
9 increase but we have enough inventory in the tank.

10 We discussed the SRV cycles and the peak
11 drywell and containment temperatures.

12 And I understand there was some interest
13 in the power-flow map. The green region is our
14 current power-flow map. This goes up to a power level
15 of 101.7 percent of original license thermal power.
16 The maximum core flow is 105 percent of rated core
17 flow.

18 And with EPU, what we are doing is we are
19 adding in the blue section which tends to compress our
20 flow window up at EPU. That goes up to 115 percent.
21 There are plants that have gone up to 120 percent. We
22 have got Vermont Yankee in our fleet that operates at
23 120 percent. And as you can tell from the way that
24 curve is going, they have an even smaller flow window.
25 They are able to work with that flow window. It is

1 not optimum from a core design perspective and the
2 core designers would like some more flexibility in
3 that. So we are pursuing a MELLLA+ submittal. With
4 the analysis ongoing right now, that will widen that
5 flow window for us.

6 MEMBER BANERJEE: What is the minimum flow
7 in the flat region right now?

8 MR. BROADBENT: The minimum flow in the
9 flat region is 77 percent.

10 MEMBER BANERJEE: So that blue region
11 there, that is what I mean -- the top. I'm sorry.

12 MR. BROADBENT: The top, that is 93
13 percent.

14 MEMBER BANERJEE: And you have 105 on the
15 other side?

16 MR. BROADBENT: We are licensed to 105.
17 We do have jet-pump fouling that is not allowing us to
18 reach over 100. So we are -- our real window is
19 between 93 and 100.

20 CONSULTANT WALLIS: So this isn't to
21 scale?

22 MR. BROADBENT: No, it is.

23 CONSULTANT WALLIS: It is?

24 MR. BROADBENT: This is our license.

25 CONSULTANT WALLIS: Because the other ones

1 are over 100.

2 MEMBER BANERJEE: No, the other one would
3 work at 80. Right?

4 MR. BROADBENT: The other one was 77.

5 MEMBER BANERJEE: No, I mean if you get to
6 the purple.

7 MR. BROADBENT: Yes, the purple is 80,
8 yes.

9 So that gets us back to where we -- to
10 what we have right now in terms of flow window.

11 MEMBER SCHULTZ: Has MELLLA+ been
12 implemented at Vermont Yankee?

13 MR. BROADBENT: No.

14 MEMBER SCHULTZ: It has not. So they are
15 dealing with it through the reload it through the core
16 design.

17 MR. BROADBENT: That's right, through the
18 core design.

19 CHAIR REMPE: So you said you are
20 independently pursuing a MELLLA+ application?

21 MR. BROADBENT: Well we are pursuing that
22 with GE. There will be a licensing submittal here by
23 the end of the year.

24 MR. THORNTON: That will be our long-term
25 strategy to open up the operating domain, give us a

1 little more flexibility with that core design.

2 MEMBER SIEBER: But there is no submittal
3 so far --

4 MR. THORNTON: Right.

5 MEMBER SIEBER: -- to NRC.

6 MR. THORNTON: Correct.

7 Okay, my name again is Thomas Thornton.
8 I am going to talk about the Power Range Neutron
9 Monitoring System and how it relates to stability with
10 the BWR core.

11 The stability in the BWR core is dependent
12 on core flow and power levels. The Power Range
13 Neutron Monitoring System is going to allow us to
14 provide a stability solution that will be required by
15 the EPU power conditions.

16 The system that we are going to install is
17 a modern digital system. It will allow for
18 operational flexibility with the components in the
19 implementation of the maximum extended load line
20 analysis that we were talking about. The system also
21 provides better accuracy in redundancy of components
22 compared to the original system that was installed.
23 The hardware is based on systems that have been
24 implemented and are in use at 15 U.S. units.

25 The system has been licensed separately.

1 It was on a separate license amendment request where
2 it was reviewed based upon the regulations for
3 instrumentation and controls including the interim
4 staff guidance for digital instrumentation.

5 CHAIR REMPE: So you said the system we
6 are going to install but I heard earlier today you
7 guys have about installed everything. We you are
8 doing the final paperwork.

9 MR. THORNTON: That's correct. It is in
10 place currently.

11 CHAIR REMPE: It is in place, okay.

12 MEMBER SIEBER: Are you using it at the
13 present time?

14 MR. THORNTON: Well we use it during our
15 startup.

16 MEMBER SIEBER: But you are using it
17 today?

18 MR. THORNTON: Well we installed it during
19 the outage.

20 MEMBER SIEBER: Okay.

21 MR. THORNTON: It will be used as we come
22 up in power.

23 MEMBER SIEBER: Oh, okay.

24 MR. THORNTON: So yes, it is in place and
25 tested and ready to go.

1 MEMBER SIEBER: Okay.

2 MEMBER SKILLMAN: How do you know it is
3 accurate?

4 MR. THORNTON: In what?

5 MEMBER SKILLMAN: In neutron population.
6 How do you know it is accurate?

7 MR. THORNTON: Well I talked a little bit
8 about --

9 MEMBER SKILLMAN: It's like a guy with two
10 watches.

11 MR. THORNTON: In terms of some of the
12 components that are still utilized, the detectors and
13 the local power range monitors are the same
14 instrumentation that is currently -- been used
15 previously. So in terms of detection capability, you
16 know it is really unchanged from the sensors. Okay?

17 Where we get into the new equipment is the
18 average power range monitor modules that combine the
19 local power range monitors into challenges that are
20 then processed through the system.

21 The power range system that is being
22 installed will allow for more diversity with the voter
23 logic modules that are installed, will provide for
24 trips on two out of four channels. So, we expect the
25 system to provide as good or better capability than

1 the original system. Certainly a system that is very
2 reliable for us.

3 MEMBER SKILLMAN: But how do you know?

4 MR. KRUPA: This is Mike Krupa again. The
5 system is calibrated with reactor engineering. You
6 know they do a core heat balance and they calibrate
7 the APRM system to assure that it is reading what the
8 real core conditions are.

9 We have always done it this way. You take
10 the LPRN inputs and you adjust the gains based on the
11 heat balance. So that won't change.

12 MEMBER SIEBER: With the exception of
13 logic modules, everything else is analogue?

14 MR. THORNTON: Well yes, correct, as far
15 as the signals coming into the local power range
16 modules and then into the power range system.

17 MEMBER SIEBER: Okay.

18 MEMBER BANERJEE: You did an MUR on this,
19 right, at some point?

20 MR. THORNTON: On this unit, yes.

21 MEMBER BANERJEE: Was it a dual-beam or a
22 Caldon?

23 MR. THORNTON: A Caldon.

24 MEMBER BANERJEE: Yes, which? Dual-beam
25 or single beam?

1 MR. THORNTON: LEFM check-plus --

2 MEMBER BANERJEE: Okay, check-plus.

3 MR. THORNTON: -- plus multiple beams.

4 MEMBER SKILLMAN: Thank you.

5 MR. THORNTON: Okay. The other thing that
6 the Power Range Neutron Monitoring System will add is
7 the Oscillation Power Range Monitor, which will allow
8 us to implement the new stability solution for
9 monitoring of oscillations.

10 The Option III core stability solution
11 will be our stability solution that is implemented.
12 It provides for more sensitive detection capability,
13 allowing detection of regional oscillations within the
14 core. It also provides for suppression of automatic
15 trips, based on detection, through this Oscillation
16 Power Range module. And the algorithms that it
17 incorporates, the module does contain improved
18 algorithms to those that we currently have in place
19 for detection of oscillations. And when it is
20 initially installed, it will have alarms active on it
21 that will be monitored for a period of time to ensure
22 that the system is stable and they were not, we don't
23 experience any spurious trips on the system. This is
24 allowed within the submittal and then we will put the
25 trips into place and utilize those based upon the

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1 data, set up based upon the data that is observed
2 during this monitoring period.

3 CONSULTANT WALLIS: Now the way this works
4 is you have got signals, oscillatory signals. And
5 there has to be some logic that says are we headed for
6 instability or is this a spurious signal you have to
7 say how many oscillations do we accept to say it is a
8 real oscillation, where do we cut off and say the
9 amplitude is big enough to say it is a real
10 oscillation. All these things are important and we
11 have been into this before.

12 Now is this something that GE supplies
13 with you or do you have to make all of these decisions
14 yourself about when is it an oscillation and when
15 isn't it, and all that stuff?

16 MR. THORNTON: It is an implementation of
17 the General Electric methodologies.

18 CONSULTANT WALLIS: So GE looks over your
19 shoulder or GE guarantees this is the right way to do
20 it?

21 MR. THORNTON: They provide us the
22 algorithms for the detection of the oscillation.

23 CONSULTANT WALLIS: So they are
24 responsible for the operation.

25 MR. THORNTON: And we have reviewed that

1 information and the methods in which it is detected to
2 determine those are applicable.

3 CONSULTANT WALLIS: You don't change them
4 in any way. You just accept that they say so many
5 oscillations and detections and all that stuff.

6 MR. THORNTON: We feel like they are
7 applicable to our design and our core.

8 CONSULTANT WALLIS: So it is a standard
9 thing that is applied to other plants as well as
10 yours.

11 MR. THORNTON: Yes.

12 CONSULTANT WALLIS: Thank you.

13 MR. VEDOVI: This is Dr. Juswald Vedovi.
14 Technical Leader for stability analysis GEH. In
15 addition to that, we during the monitoring period,
16 Entergy will collect these LPRM and OPRM data and
17 provide to GEH and we will perform evaluations to
18 confirm that the signals are performing as designed.

19 MEMBER SCHULTZ: Are there any special
20 tests that are focusing on gathering information that
21 would be directly applicable to stability? No
22 stability testing is being done.

23 MR. VEDOVI: No stability testing but just
24 collection of LPRM and OPRM signals. The system is
25 able to collect the data at high resolutions in the

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1 order of 1500 milliseconds. And those data were
2 stored and provided to us.

3 MEMBER SCHULTZ: And then you will do
4 confirmatory evaluation. Is that what we would term
5 it?

6 MR. VEDOVI: Correct. Confirmatory
7 evaluations and phosphorous transfer analysis to
8 confirm they are not like frequency in the range of
9 stability that are of concern.

10 MEMBER SCHULTZ: Thank you.

11 MR. VEDOVI: Thanks.

12 MR. THORNTON: Okay, this is a system that
13 can operate at current licensed thermal power. The
14 only transition that we will have in going to extended
15 power uprate would just be a rescaling of our trip-
16 enabled region within our operating domain. So really
17 minimal impact with respect to that transition to
18 extended power uprate. Okay.

19 CHAIR REMPE: I think is a good time to
20 have a break. We will recess until 10:15.

21 MR. VERROCHI: I would like to just make
22 one comment on the previous questions on SRVs. This
23 is Steve Verrochi again.

24 CHAIR REMPE: If you want to just hold
25 that until we come back from the break.

1 MR. VERROCHI: That's fine.

2 CHAIR REMPE: Okay. Since, I recessed,
3 you can't talk. Sorry.

4 (Whereupon, the foregoing matter went off
5 the record at 9:58 a.m. and went back on
6 the record at 10:14 a.m.)

7 CHAIR REMPE: Okay, so I guess we are
8 going to un-recess and restart the meeting. Do you
9 want to start off, sir?

10 MR. SMITH: Good morning. My name is Fred
11 Smith. I am the Manager for Fuels and Analysis at
12 Entergy. And I am going to be talking a little bit
13 about the fuel design and some special topics.

14 So Cycle 19 will be our first core that
15 operate at extended power conditions. Grand Gulf is
16 a 900 bundle core. Cycle 19, the fresh batch will be
17 364 bundles of GNF2 fuel. The last cycle we inserted
18 308 bundles. So we have a few bundles of GE14-
19 dominant core design for Cycle 19 with a GNF2.

20 CHAIR REMPE: When do you plan to start
21 using Cycle 19?

22 MR. SMITH: Start?

23 CHAIR REMPE: Yes.

24 MR. SMITH: In about a week.

25 CHAIR REMPE: It will start in about a

1 week, okay.

2 MR. SMITH: Yes. From a fuel performance
3 perspective, all of the fuel will have PCI resistant
4 cladding. We have implemented defender lower tie
5 plate design for debris resistance. This is a
6 relatively new design that has multiple flow paths to
7 catch debris. And then we also full core will use
8 Zirc 4 channels to enhance our margin to channel bow
9 effects.

10 The Cycle 19 core design evaluations have
11 been complete and we completed them for both the
12 current license power and for extended power uprate
13 and the reload licensing is all done.

14 CHAIR REMPE: So I was trying to look up
15 last night, what is the main difference with the GNF2
16 fuel versus the GE14? Is it the enrichment? Is it --

17 MR. SMITH: No, the principle differences
18 are the GNF2 has more part-length fuel rods, uses
19 Inconel spacers instead of Zirc 4 spacers.

20 CHAIR REMPE: Okay.

21 MEMBER SKILLMAN: Is there a penalty or a
22 limitation when you had the fresh reload of GNF2 and
23 operated at a significantly lower power load? Because
24 it is loaded with 235 for the higher power level.

25 MR. SMITH: We designed the core for

1 extended power uprate. And so when we operate at
2 current license power we will have significantly more
3 margin than we would for the extended power uprate.

4 MEMBER SKILLMAN: Well I understand that
5 but I am asking kind of the flip side of that
6 question. Is there a downside to that?

7 MR. SMITH: No, not from a fuel design
8 perspective.

9 MEMBER SKILLMAN: I understand. No, not
10 from a fuel design perspective. Thank you.

11 MR. SMITH: The EPU is evaluated per one
12 of the GE topical 33173. That topical identified 24
13 limitations for applicability. Thirteen of those
14 limitations were applicable to the Grand Gulf EPU.
15 All 13 of them met. Eleven of those restrictions
16 don't apply. For example, there are some restrictions
17 that are related to very high gd loadings. We are not
18 using 10 percent or more of gad. We are not using --
19 We haven't licensed it for MELLLA+ so those
20 restrictions don't apply.

21 So the GE methods have been confirmed to
22 be appropriate for this core design.

23 This request to talk about thermal
24 conductivity, this is a subject of some discussion in
25 the industry today, although it is not really new for

1 GE. The NRC staff and GE have been discussing this
2 since 2006. The PRIME, new PRIME Thermal-Mechanical
3 Code fully addresses this topic. That was approved
4 in 2010. And our EPU was performed consistent with
5 the Licensing Topical Report for PRIME.

6 That includes a PRIME-based Thermal-
7 Mechanical Operating Limit and a period of transition
8 to other vent analysis based on PRIME. That
9 transition is ongoing. Those analysis, for example,
10 the LOCA analysis for EPU is based on GESTR. It will
11 be revised in the next cycle to use PRIME.

12 The potential impact of that, we have
13 looked at that briefly, and it is in the order of 50
14 degrees change in PCT. And as you saw earlier, we
15 have over 300 degrees -- well, over 500 degrees
16 margin. So that transition doesn't pose any safety
17 issue to us.

18 MEMBER SCHULTZ: Fred, in the conditions
19 related to the uprate, the license conditions or the
20 commitments, I should say, associated with the uprate,
21 there is a commitment that is associated with the fuel
22 rod thermal-mechanical performance evaluation. And
23 that will be done each operating cycle. I presume
24 that is already done. Is this new because it is being
25 done with new methodology?

1 MR. SMITH: The fuel mechanical evaluation
2 is done or evaluated for each fuel pipe confirmed.
3 And that will be done every cycle.

4 MEMBER SCHULTZ: I was just trying to
5 understand why it was listed as something that seemed
6 special. Is it just not special but listed as part of
7 the commitments?

8 MR. BURFORD: Yes, it may have been
9 brought in, recognized as a commitment to when it was
10 really a description of our ongoing program for the
11 methodology. But it is picked up.

12 MEMBER SCHULTZ: And it is listed as a
13 continuing commitment.

14 MR. BURFORD: Yes.

15 MEMBER SKILLMAN: Is this your COLR, your
16 core operating limits report through your next cycle?
17 Is that what you are describing here?

18 MR. SMITH: The COLR is a product of this
19 analysis.

20 MEMBER SKILLMAN: I understand that.

21 MR. SMITH: Yes, so the SRLR, the reload
22 analysis produces the COLR. The tech specs refer to
23 the COLR for the operating limits.

24 MEMBER SKILLMAN: So the COLR is really
25 the administrative vehicle to implement this for your

1 license.

2 MR. SMITH: The COLR will include the
3 reference methodologies that we are licensed to and
4 the specific limits that operations will adhere to.

5 MEMBER SKILLMAN: Thank you.

6 MEMBER SCHULTZ: Fred, before you leave
7 the core discussion, in the staff's SER and evaluation
8 they refer to work that both have you done and they
9 had done in confirmation related to I think it would
10 have been the equilibrium core evaluation. And the
11 conclusion was that the peak bundle power was expected
12 to increase about 5.4 percent is the number that they
13 have and they are going to present later, after the
14 EPU. And my question is, as the reload analysis has
15 been done for Cycle 19, is that the range of increase
16 that has been achieved or that you have seen? Or is
17 there any -- they have indicated that that is
18 acceptable, typical for operated cores. And I was
19 just wondering what happened in the actual reload
20 analysis as you would expect for the next cycle.

21 MR. SMITH: Yes, to get the actual number
22 I will have to look that up, but in general, I can
23 answer the question more broadly.

24 The sites, the cores that are designed at
25 Grand Gulf are going to be limited by critical power

1 performance. And that performance is a function of
2 fuel design type GNF2. And that performance, those
3 limits are not changed by EPU. And so while the
4 bundle power may go up, you notice the five percent is
5 less than the 13 percent that we are upgrading. And
6 so the critical power performance will also constrain
7 the peak bundle power.

8 So I can arrange to get the maximum --

9 MEMBER SCHULTZ: If you could just confirm
10 that you are still within that range --

11 MR. SMITH: Certainly.

12 MEMBER SCHULTZ: -- that the staff
13 expected, I would appreciate it. Thank you.

14 MEMBER BANERJEE: Do you take this into
15 account also for your AOOs, like turbine trips? Does
16 it have any effect?

17 MR. SMITH: They were evaluated every
18 cycle.

19 MEMBER BANERJEE: So you use the TC model
20 for that analysis?

21 MR. SMITH: The transition, once we
22 transition to PRIME, to the PRIME methodology, then
23 those effects would be account for for the current
24 cycle. They are using GESTR-M with some adjustments
25 and those effects from a CPR perspective have been

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1 illustrated to be relatively minor.

2 MEMBER BANERJEE: So let me sort of think
3 this through. TCD should actually slightly slow down
4 the void effects. What does GE see there in the AOs?

5 MR. JAHINGIN: Yes, this is Nayem Jahingin
6 from GE.

7 COURT REPORTER: Speak directly into the
8 mike.

9 MR. JAHINGEN: You asked a person about
10 TCD in the containment analysis. So what we have
11 seen is conductivity, thermal connectivity is going
12 down with exposure. It is actually increasing the
13 time constraint for the full. So the response, the
14 temperature response you see is actually a little
15 higher on the transients. But again, this is compared
16 against the limit based on the exposure degradation of
17 the conductivity. So it is kind of checked there.

18 But yes, in terms of getting a response it
19 is slightly higher.

20 MEMBER BANERJEE: So when you discuss
21 this, I would be just interested to understand it.
22 There are effects on things like OLMCPR.

23 MR. JAHINGIN: Yes, this is Nayem Jahingin
24 -

25 COURT REPORTER: Just speak straight into

1 it but not so close.

2 MR. JAHINGIN: Okay.

3 COURT REPORTER: Sorry. It's sensitive.

4 MR. JAHINGIN: Is this okay?

5 COURT REPORTER: That's fine.

6 MR. JAHINGIN: So yes, the impact we have
7 evaluated with our existing code we actually
8 implemented TCD model and all applicable methods for
9 transients. And what we see is very minor, in terms
10 of CPR. There is really negligible intake.

11 MEMBER BANERJEE: Okay, what about on the
12 power shapes and things?

13 MR. JAHINGIN: I don't know.

14 MEMBER BANERJEE: Negligible?

15 MR. JAHINGIN: Negligible, yes,

16 MEMBER BANERJEE: But you have done the
17 evaluation.

18 MR. JAHINGIN: We have done that initially
19 when we are doing the bind review, we have done that
20 with TRACG because TRACG had both model, explicit and
21 non-explicit and now we are doing it with actual
22 methodology that will be implemented. So that is an
23 ongoing process but we are almost done with
24 implementing.

25 We have done both ways.

1 MEMBER BANERJEE: Thank you.

2 MEMBER SCHULTZ: Fred, what is the recent
3 fuel performance experience at Grand Gulf?

4 MR. SMITH: Grand Gulf has had a failure
5 last cycle, a single failure. It was attributed to
6 debris. We did an inspection. We found debris in not
7 the top spacer but the next to the top spacer.

8 Prior to that, we had not had failures in
9 three cycles. So we had had a pretty good history but
10 we are disappointed that we did have a debris failure
11 this cycle.

12 MEMBER SKILLMAN: What was the debris,
13 please?

14 MR. SMITH: We don't know because it
15 wasn't present. You know, we know that it was debris
16 because when we pulled the pin up, we can see the
17 debris mark under the spacer. It appears to have been
18 a small wire but it wasn't recoverable.

19 MEMBER SKILLMAN: Thank you.

20 MEMBER SCHULTZ: Thank you.

21 CONSULTANT BONACA: Did you shadow?

22 MR. SMITH: Pardon?

23 CONSULTANT BONACA: Did you shadow the
24 assembly?

25 MR. SMITH: Shadow the assembly?

1 CONSULTANT BONACA: Suppress.

2 MR. SMITH: Oh, yes. Yes, we did
3 suppression testing. When we first detected the
4 failures, it was a very, very tight failure. We did
5 suppression testing. We put two blades around the
6 failed location and we had, we actually had the xenon
7 drop to below what we thought would have been normally
8 detectible levels. But we did find it through still
9 being in the outage.

10 CONSULTANT BONACA: Okay.

11 MR. SMITH: Another topic that was
12 requested to talk about, the spent fuel pool
13 criticality analysis.

14 The criticality analysis initially we --
15 well, we concluded that really it is not impacted by
16 EPU, per se. We do demonstrate that we meet the Part
17 General Design Criteria 62 based on cycle-specific
18 evaluations. Grand Gulf does use neutron absorber
19 materials in our racks. Those materials Boraflex have
20 known degradation mechanisms. We have a monitoring
21 program that has been approved by the NRC. We
22 implement that program.

23 Prior to the EPU, we were developing a new
24 criticality safety analysis. That analysis was
25 submitted to the NRC and is currently under review.

1 We received some RAIs and expect some more. We have
2 implemented a conservative licensing condition while
3 that review is being completed.

4 CHAIR REMPE: Does this new analysis
5 include a misloading event?

6 MR. SMITH: We have had a number of
7 discussions with the staff about misloading event and
8 we are, our first pass was to look at it from a
9 probabilistic perspective. We believe we probably
10 would draw that approach and include a specific
11 misload event.

12 CHAIR REMPE: So you anticipate you are
13 going to be submitting an updated one. Right?

14 MR. SMITH: That's right.

15 MR. BROADBENT: And I believe we are going
16 to be switching up at this point --

17 MR. SMITH: Yes.

18 MR. BROADBENT: -- for the staff
19 presentation.

20 CHAIR REMPE: Are you guys all ready?

21 MR. RAZZAQUE: Yes. I am Muhammad
22 Razzaque from the Systems Branch. And I am going to
23 present the reactor systems review results.

24 The EPU review scope included effects,
25 looking into the effects of EPU on Grand Gulf --

1 MR. MARCH-LEUBA: Excuse me, what is the
2 slide?

3 CHAIR REMPE: Start on ten probably -- Oh,
4 I'm sorry. Beyond ten. I'm sorry. There you go.

5 MR. RAZZAQUE: The areas that we are
6 looking to the impact of EPU are fuel system, thermal-
7 hydraulic design, overpressure protection system,
8 transient analysis, LOCA, ATWS, and the GE methods,
9 applicability of GE methods -- interim methods that
10 are in EPU and GNF2 fuel.

11 Review method included for the licensee
12 followed the guidelines provided in ELTR-1, ELTR-2,
13 and CPPU. And the analyses were based on approved
14 methodologies, analytical methods and codes and they
15 applied those items.

16 And the SER, staff SER was written based
17 on the guideline of RS-001.

18 Fuel system and nuclear design. The next
19 cycle, which is Cycle 19 will be the first EPU core
20 which will comprise mostly GNF2 fuel and some legacy
21 fuel and GE14. The equilibrium core, therefore, they
22 used to perform the calculations for this EPU was
23 based on a GNF2 equilibrium core. However, the reload
24 analyses, which is documented in SRLR will provide the
25 exact core results. And we verified that, that those

1 are bounded by the ones which we approved.

2 Peak bundle power is about 5.4 percent
3 within the experience based, based on our previous EPU
4 review. We have seen up to six, I think I have seen
5 up to seven percent. So technically, the peak power
6 should increase. It is basically flattening of power
7 profile but in reality it does increase. We have seen
8 it increase not at the rate of what the overall power
9 is. Overall power is 15 percent. It doesn't increase
10 to that level. The idea is to flatten the power
11 profile and maximize the power output and keep the
12 peak bundles constant so that the safety limits are
13 still essentially within the limits.

14 And the thermal limits are verified again

15 --

16 CONSULTANT WALLIS: What about the burnup?

17 MR. RAZZAQUE: Pardon me?

18 CONSULTANT WALLIS: What is the burnup
19 limit? Is the burnup limit about the same as before?

20 MR. RAZZAQUE: The burnup limit I have
21 seen is 70. They have provided the burnup curve up to
22 70 gigawatt-days metric ton uranium, yes. That is the
23 result we have reviewed.

24 MR. SMITH: This is Fred Smith. The
25 burnup limit won't change. The burnup performance

1 will tend to drop with EPU.

2 MR. RAZZAQUE: The result I have seen is
3 up to 70 gigawatt metric ton uranium.

4 MR. SMITH: That is the burnup pellet
5 limit, I believe is 70.

6 CHAIR REMPE: Okay, I think you need to
7 introduce yourself. Right?

8 MR. SMITH: I'm sorry. I'm Fred Smith.

9 MR. RAZZAQUE: Okay, and the hot excess
10 reactivity and shutdown margin, those are also
11 verified based on the GESTAR-II methodology.

12 The analysis of the accidents and
13 transient overpressure protection is one of them. So
14 we looked into that. We see the results are within
15 the safety limits. The ODYN code was used to 102
16 percent EPU power and the limiting event, as usual, is
17 the MSIVF, which is main steam isolation valve closure
18 flux scram. Seven SRVs were assumed out of service
19 out of 20 and peak pressure was --

20 CONSULTANT WALLIS: What is the
21 significance of seven?

22 MR. RAZZAQUE: I cannot give you an exact
23 answer why they picked seven but my guess is to keep
24 as much flexibility as possible. In other words, they
25 can go without seven and still do anything,

1 essentially, except gets the idea.

2 CONSULTANT WALLIS: There is no realistic
3 estimate.

4 MR. RAZZAQUE: They are within here. But
5 the limit is the pressure. They have to do within
6 that. So that is the limit.

7 So they have seven is quite, to me, it
8 looks like from a past experience quite a large number
9 of them that they can be still out of service. Some
10 of them as two or three can be allowed. So it depends
11 on the plan's ability to have those kind of margins.

12 CONSULTANT WALLIS: So the reason the peak
13 pressure is so high is because they have assumed this
14 number seven.

15 MR. RAZZAQUE: Right. It would have been
16 lower if they were --

17 CONSULTANT WALLIS: It's another
18 prediction of what is likely to happen.

19 MEMBER SIEBER: No.

20 MR. RAZZAQUE: If seven fails, then --

21 CONSULTANT WALLIS: If three fails they
22 are in trouble. Right?

23 MR. RAZZAQUE: Eight failures, we don't
24 know. They may be in trouble but maybe. It is out of
25 the analysis. I mean, out of the analyzed data.

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1 No SRV setpoint change is required because
2 it is the constant pressure for operating and no other
3 changes to SRV were needed. Again, the most limiting
4 pressurization will be verified during reload.

5 So this is a two-step process during the
6 EPU based on the equilibrium core and then to verify
7 again when they know the exact core.

8 Standby liquid control system is a
9 manually operated system for Grand Gulf. The 86 gpm
10 boron equivalency is satisfied. Sufficient margin
11 exists for the pump discharge relief valves to remain
12 closed during system injection. That we verified
13 actually significantly.

14 CONSULTANT WALLIS: I don't understand
15 what gpm boron equivalency means.

16 MR. RAZZAQUE: Okay, the ATWS rule says
17 that you have to have 86 exactly -- let me see. Boron
18 injection probability have to be equivalent to 86 gpm
19 of 13 percent weight of actual boron --

20 CONSULTANT WALLIS: Oh, okay.

21 MR. RAZZAQUE: -- into a 251-inch vessel.

22 CONSULTANT WALLIS: You have to say what
23 the concentration of boron is.

24 MR. RAZZAQUE: Right. In short, I just
25 say 86 but this is the rule.

1 CONSULTANT WALLIS: But gpms aren't
2 important. It is the amount of boron that matters.

3 MR. RAZZAQUE: Exactly. And there is an
4 equation they call boron equivalency which all those
5 go in there.

6 CONSULTANT WALLIS: It's a pretty strange
7 definition. Okay.

8 MR. RAZZAQUE: So the --

9 CONSULTANT WALLIS: And at what
10 temperature? I mean, they are all -- Well, I guess
11 you know what you are doing.

12 MR. RAZZAQUE: Yes, the variables in the
13 equations are the flow rate, volume of the vessel,
14 concentration of boron and enrichment of boron. Those
15 are the four terms in the equation. Normally the gpm
16 is limited by the pump capacity and the volume, of
17 course, they cannot change it. So they are left with
18 two things that they can essentially change,
19 enrichment and the concentration.

20 CONSULTANT WALLIS: Right.

21 MR. RAZZAQUE: Okay, again, so the fourth
22 bullet, shutdown boron concentration 660 does not
23 change for EPU. Again, concentration, they did not
24 change concentration. However, they increased the
25 enrichment.

1 CONSULTANT WALLIS: You are going to talk
2 about ATWS later, are you?

3 MR. RAZZAQUE: ATWS output, or the ATWS
4 result, yes. And Dr. Huang and Dr. Jose will talk
5 about the stability part of the ATWS as well as normal
6 operation.

7 Okay, now into the AOOs. The three areas
8 that we typically look at the AOOs, which one gives
9 the maximum delta CPR; in other words, therefore they
10 effect the OLMCPR. And it is the general load
11 rejection no bypass that was the highest. And
12 typically that is the highest in BWRs, as far as the
13 MCPR is concerned.

14 Overpressure as I just talked about is the
15 MSIVF. And the final one is the loss of water level,
16 which happens to be the loss of feedwater flow which
17 causes that to happen. And those were the limiting
18 events in those areas and they were within the safety
19 limits that are allowed.

20 Again, those will be verified for cycle-
21 specific to make sure that they still make those
22 limits.

23 ECCS LOCA SAFER/GESTR load was used, which
24 is an Appendix K code and therefore the results were
25 based on Appendix K, less than 1690 for a large break

1 LOCA. Quite a bit of margin there.

2 And the large break --

3 CONSULTANT WALLIS: You did some
4 confirmatory analysis of that?

5 MR. RAZZAQUE: For this one we don't just
6 routinely do it. We see the need for doing it. In
7 this case, the staff decided after asking questions,
8 had responses, and seeing the margins, sufficient
9 margin, we didn't do any just redo a calculation
10 again.

11 CONSULTANT WALLIS: I thought you said, I
12 thought your SER said you did.

13 MR. RAZZAQUE: Not independent
14 calculation.

15 CONSULTANT WALLIS: And you got a PCT of
16 1560. Did I misread something?

17 MR. RAZZAQUE: SER says that the SER input
18 on the audit calculation portion. If you look at that
19 section, it did say that based on the margin available
20 and our satisfaction of the RAI responses, we did not
21 do any independent calculations. This is on -- I
22 don't know what the final page number is.

23 CONSULTANT WALLIS: Okay, that's all
24 right. Thank you, that's fine.

25 MR. RAZZAQUE: Yes, you can look at that.

1 But we do it but in this case we thought this was not
2 necessary.

3 In this case the reload analysis will
4 confirm that the MAPLHGR is within the limit that was
5 assumed for this calculation. All of the Appendix K
6 10 CFR 50.46 requirements are met.

7 ATWS results. Again, the ATWS mitigation
8 requirement requires that you ask for these
9 requirements. There are three basic requirements.
10 One is there has to be an alternate rod insertion,
11 which they have. And they have to satisfy the boron
12 injection capabilities, which they did. And then the
13 third one is that the ATWS-recirc pump trip logic have
14 to be installed and they have. And so they met that
15 rule, ATWS rule.

16 Operator action. There are operator
17 action that need to be done, which is to follow the
18 EOP owners' group EPG/SAG, Rev. 2. The EPU are not
19 significantly burden to the operators' action for
20 Grand Gulf. And it was confirmed by staff audit with
21 these two gentlemen performing the audit and they will
22 talk about it, I guess.

23 Results of the ODYN code of ATWS provided
24 the pressure, which is less than 1500 as well as the
25 PCT, which is 1560. This was ATWS, I may have

1 mentioned, I don't know, but the 1560 was for ATWS.
2 And the peak suppression pool was well within the
3 limit, 165 where the limit allowed, design limit is
4 210.

5 MEMBER SKILLMAN: Muhammad, please don't
6 change yet. The third bullet, the third box on the
7 first bullet, ATWS-recirculation pump trip logic
8 installed. Can you explain to us what that logic
9 does, please? How that functions?

10 MR. RAZZAQUE: Once the ATWS is detected,
11 that logic should trip the pumps. Right?

12 MEMBER SKILLMAN: Yes. What is its
13 trigger?

14 MR. RAZZAQUE: What is triggers? I guess
15 I think it is when the rod fails to go in.

16 MR. BROADBENT: This is Greg Broadbent
17 with Entergy. It is based on high steam dome
18 pressure. So, usually with an ATWS you will see a
19 significant pressurization and based on high steam
20 dome pressure, then we will get that ATWS tripped.

21 MEMBER SKILLMAN: Thank you.

22 MR. RAZZAQUE: So the logic is based on
23 that, not on the rod -- detecting the rod failed to
24 move in. I don't know exact logics what triggers it.
25 It looks like you answered that.

1 MEMBER SKILLMAN: Thank you.

2 MEMBER BANERJEE: You are not doing
3 anything to the feedwater?

4 MR. RAZZAQUE: To --

5 MEMBER BANERJEE: ATWS.

6 MR. RAZZAQUE: No, the rules are these top
7 three.

8 MR. MARCH-LEUBA: If I may, Muhammad.

9 MR. RAZZAQUE: Yes, go ahead.

10 MR. MARCH-LEUBA: There are two different
11 things. This is Jose March-Leuba from Oak Ridge.

12 There are two different things. The first
13 is the ATWS rule which applies, which is how ours was
14 defined, and that requires you to trip the secretion
15 flow to release the power immediately. And then after
16 the ATWS rule, during the ATWS instability analysis,
17 we came up with what is called the ATWS mitigation
18 actions which require you to lower the water level
19 also.

20 So the ATWS rule requires you to trip the
21 pumps. The ATWS mitigation actions requires you to
22 lower the water level.

23 MEMBER BANERJEE: But you are going to do
24 mitigation here or not?

25 MR. MARCH-LEUBA: Yes.

1 MEMBER BANERJEE: That is not clear from
2 this. Okay, I understand the reason.

3 MR. RAZZAQUE: Would that be part of the
4 operator action?

5 MR. MARCH-LEUBA: It is an operator
6 action. It is part of the Emergency Operating
7 Procedures Revision 2.

8 MR. RAZZAQUE: Okay, so that is -- Don't
9 worry. It will be butted in there somewhere.

10 MR. MARCH-LEUBA: And in most plants, for
11 example, in Grand Gulf --

12 MEMBER BANERJEE: The question is what
13 does the EPU do to the time available? Is there any
14 significant effect?

15 MR. MARCH-LEUBA: Absolutely nothing, to
16 be honest. Because the first thing you do is you trip
17 the pumps. And after you trip the pumps, you don't
18 have any memory of where you were. You go back to
19 another circulation. And the power, the operating
20 power and flow after you trip the pumps is the same
21 under EPU or OLTP. It only depends on your rod line.
22 And it is the same rod line.

23 MEMBER BANERJEE: But aren't you closer to
24 the instability boundaries?

25 MR. MARCH-LEUBA: By tripping the pumps,

1 you manually work the plant into the instability
2 boundary. And that is where you have the ATWS
3 instability.

4 MEMBER BANERJEE: Oh, I see. I got it.
5 Thank you.

6 MR. MARCH-LEUBA: We do have a plot for
7 that.

8 MEMBER BANERJEE: Yes. I mean, I think
9 this is an interesting thing but it is the same for
10 all EPUs.

11 MR. MARCH-LEUBA: That's correct.

12 MEMBER BANERJEE: So there is no reason to
13 pursue it further here.

14 MR. MARCH-LEUBA: On the particular case
15 of Grand Gulf, they have the high pressure injection
16 into the vessel is feedwater pumps, which are driven
17 by steam. So the moment you close your MSIV, you
18 don't have a steam for those pumps and you terminate
19 injection automatically, within a few -- there is some
20 time delay because of the storage of steam in the
21 volumes.

22 So even if the operator were not to reuse
23 the flow, the plant will terminate flow by itself.

24 Thank you.

25 MR. RAZZAQUE: So that concludes the first

1 part of my presentation, which is basically that the
2 Grand Gulf PUSAR is consistent with the NRC-accepted
3 guidelines and generic evaluation from the limits and
4 the applicable safety analyses will be reanalyzed and
5 confirmed, reconfirmed NRC approval.

6 CONSULTANT WALLIS: I have a question for
7 you. Are you going over the control at all? I just
8 wondered if you were still accepting 280 calories per
9 gram. That is what it says.

10 MR. RAZZAQUE: Yes.

11 CONSULTANT WALLIS: You are still
12 accepting 280 calories per gram?

13 MR. RAZZAQUE: Yes.

14 CONSULTANT WALLIS: Okay.

15 MEMBER BANERJEE: This is an old story.

16 MEMBER SHACK: There are traditions we
17 have to maintain, Graham.

18 MEMBER BANERJEE: You always have to
19 allude to this in the letter. Remember, Joy.

20 CHAIR REMPE: I'll ask you to write that.

21 (Laughter.)

22 MR. RAZZAQUE: Okay, that brings me to the
23 second part of my presentation which is the fuel
24 methods evaluation for Grand Gulf.

25 The objective and scope. The objective is

1 to assess applicability of approved GE fuel methods to
2 Grand Gulf EPU conditions. The scope is limited to
3 topics included in Interim Methods, LTR, which is
4 NEDC-33173. And the other part of this scope is the
5 applicability of GE Methods to GNF2 fuel because the
6 original interim report was done up to GE14.

7 MEMBER BANERJEE: But it was now that the
8 GNF2 has been approved, has it?

9 MR. RAZZAQUE: Yes, yes. So this is
10 supplement to it.

11 MEMBER BANERJEE: Oh, supplement whatever.

12 MR. RAZZAQUE: Yes, Supplement 3.

13 MEMBER BANERJEE: Three, yes.

14 MR. RAZZAQUE: I am going to come to that
15 next as part of the applicability of matters to GNF2.

16 And the Interim Methods LTR overview,
17 which basically describes applicability of GE methods
18 to thermal hydraulics for BWR EPU and MELLLA+
19 application. In this case of course it is not
20 MELLLA+, it is just EPU MELLLA.

21 And there are limitations and conditions,
22 24 of them.

23 MEMBER BANERJEE: How many plants are in
24 MELLLA+?

25 MR. RAZZAQUE: None.

1 MEMBER BANERJEE: Zero, right?

2 MR. RAZZAQUE: Yes.

3 MEMBER BANERJEE: But the first one will
4 be which one?

5 MR. MARCH-LEUBA: There has been a
6 submittal by Monticello.

7 MEMBER BANERJEE: Yes. We are interested
8 in the data.

9 MR. MARCH-LEUBA: Those are hold because
10 of the containment issue.

11 MR. HUANG: We will address that issue on
12 the containment. You know, keep capacity temperature
13 limits, yes, we are going to have that, too in the
14 slides.

15 MR. MARCH-LEUBA: So the question is there
16 is only one official submittal in-house and we know
17 the industry is working actively on submitting more.
18 But that is not in-house.

19 MR. RAZZAQUE: Unofficially, the Research
20 of NRC did some code calculation, TRACE calculation
21 for stability part. And it looks like the result
22 doesn't look that good. So that is maybe another area
23 getting to problem. But that was --

24 MEMBER BANERJEE: Confirmatory
25 calculation?

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1 MR. RAZZAQUE: Confirmatory calculation.

2 Just a week ago I attended a seminar where
3 we presented it. So we are still in that situation.

4 MEMBER BANERJEE: That is compared with
5 TRACG calculations?

6 MR. RAZZAQUE: I don't think actually it
7 was compared. Maybe it was compared. But the result
8 of TRACE wasn't --

9 MEMBER BANERJEE: Tony wants to say
10 something.

11 MR. ULSES: Yes, actually Dr. Banerjee,
12 the short answer is that we are still looking at it.
13 It is still under review. We do have some results
14 from research. We are actively engaging GE and the
15 industry right now to try and understand the
16 differences. At this point, I don't think we are
17 really prepared to get into the details on that.

18 In terms of licensing, we have no approved
19 MELLLA+ applications and we will not approve any
20 MELLLA+ applications until we resolve these issues is
21 essentially the short answer.

22 MEMBER BANERJEE: Thank you.

23 MR. ULSES: Thanks. And this is Anthony
24 Ulses. I'm the Branch Chief of the Reactor Systems
25 Branch.

1 MR. RAZZAQUE: Okay, the report was
2 approved and ACRS concurred.

3 The real approach was ensure compliance to
4 plant specific application process specific to Interim
5 Method LTR and make sure that the limitation
6 conditions are met and that the key core parameters
7 within experience base. Additional assessment for
8 GNF2 fuel also was part of the review.

9 And staff has verified that Grand Gulf
10 complies with all applicable limitation conditions
11 specified in the SCR and Grand Gulf key core
12 parameters are within the operating experience base.

13 Applicability of GE Methods to GNF2 fuel
14 and that was the Supplement 3 you were talking about
15 approved in December 2010, which was for GNF2. And
16 the conclusion was that it met the conditions
17 limitations as well.

18 Applicability of the GE methods continued
19 and this is the thermal-conductivity degradation
20 portion. That to address the TCD issue, staff SER
21 Condition 12 requires that PRIME Thermal-Mechanical
22 code be used for EPU. That is Condition 12. And they
23 used that and the PRIME was calibrated and validated
24 against extensive database. Effects of TCD explicitly
25 modeled in PRIME. And staff approved the code about

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1 two years, a little over two years ago.

2 Therefore, we believe that the TCD is
3 acceptably addressed.

4 CHAIR REMPE: So when the staff approved
5 PRIME, did they have FRAPCON updated and that is where
6 their comparison calcs -- or what was the history at
7 the time when it was approved?

8 MR. RAZZAQUE: Yes, I don't -- I wasn't
9 involved with the PRIME review myself but I know I
10 just viewed staff SER before coming here. And I have
11 seen that they have, when a part of the verification,
12 not just validate against the test data but also was
13 compared against FRAPCON3 runs. Okay?

14 And FRAPCON, as my knowledge goes, was
15 validated against extensive database and it is an
16 ongoing thing. As soon as new data comes, they
17 validate -- use it to validate.

18 CHAIR REMPE: So they have done some
19 comparisons and applications.

20 MR. RAZZAQUE: Right. And the comparison
21 was done that I know. Comparison with FRAPCON was
22 with the NRC ODYN code was used.

23 MR. JAHINGIN: Ms. Chairman, this is Nayem
24 Jahingin from GE. And as you pointed out, yes, we did
25 compare against FRAPCON as part of some RAI responses

1 with the PRIME. And the PRIME itself has its own
2 basis from actual thermal conductivity measurements
3 and also like integral temperature measurements we
4 have from these reactors. So we qualify against those
5 and also we compared against the FRAPCON as part of
6 the RAI response.

7 CHAIR REMPE: Okay, thank you.

8 MEMBER SIEBER: I would like to ask our
9 Designated Federal Official to provide me with a
10 reference to the analysis for high burnup fuel where
11 GE used it.

12 MR. LAI: Okay.

13 MEMBER SIEBER: Okay?

14 MR. LAI: Yes, I will work with staff.

15 MEMBER SIEBER: Thanks. Email is fine.

16 MR. LAI: Okay.

17 MR. RAZZAQUE: The conclusion of this part
18 is that Interim Method is appropriate for Grand Gulf
19 EPU. Grand Gulf complies with all applicable Interim
20 Method limitations and conditions; GE methods is
21 applicable to GNF2 fuel; and GGNS, the Grand Gulf,
22 GGNS EPU will operate within the current experience
23 base.

24 That's all my presentation.

25 MR. HUANG: I am Tai Huang from Reactor

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1 Systems Branch and I am going to present the staff
2 review on the ATWS and the stability.

3 The staff doing these evaluation by two
4 parts. One is from the submittal from the licensee
5 and second one would be staff audit to the site. You
6 know, review what their system has been prepared and
7 has done. And also their preparation for
8 implementation of the emergency operating procedures.

9 Now first part of the staff review on the
10 submittal, this will be like at Grand Gulf they have,
11 they call that the Power Range Neutron Monitoring
12 System. We start the DSS-CD functions. At this
13 moment, they only perform they implemented the PBDA,
14 PBDA-based is the other reason for the Option III,
15 long-term stability solution.

16 And CDA confirmation, that is the other
17 reason, would be implemented when they applied at the
18 MELLLA+ application in the future. So that is not
19 going to be during this operation for EPU.

20 As far as the staff audit goes, and the
21 stability ATWS cases, we first of all we are going to
22 know like simulated the ATWS conditions. And then
23 following that, you generally that other was
24 instability and how to see how the operator action in
25 the trending so that the second part audit.

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1 Dr. Jose March-Leuba going to explain that
2 to the end for the slide for the response to the --

3 MEMBER BANERJEE: Who was present at the
4 audit?

5 MR. HUANG: Myself and Dr. March-Leuba.
6 We both together.

7 All right, next slide. Now you see this
8 slide there, it shows that EPU does not change the
9 endpoint after the separation pump trip. So when you
10 pump trip EPU is on the current license same power
11 conditions there, you go into the red right there, the
12 endpoint there. So that is no difference at all.

13 Now the stability portion for this Grand
14 Gulf, they have E1A, you know, the long-term stability
15 solution they have three. You know, like Option I,
16 II, and III. And then Grand Gulf in the 1998 they
17 implement E1A solution there and armed since 2000.

18 And as part of these EPU upgrade, right
19 now they are installing a NUMAC in a digital power
20 range monitor and including solution of DSS-CD detects
21 operation solution confirmation density methodology.
22 And Grand Gulf will not arm confirmation density like
23 I mentioned previously. They only doing that PBDA or
24 the Option III solution.

25 Okay and the setpoint like you follow that

1 they are generic on this group topical report NEDO-
2 32465A published in August 1996 about the ATWS
3 stability detecting operation solution license and
4 basis in this authority for reload applications.

5 So it is going to there you know what is
6 the logic for that reset point.

7 And then there is no impact expected from
8 EPU. Option III and DIVOM methodology are applicable
9 because DIVOM's authority will show you how you set
10 these setpoints.

11 MEMBER BANERJEE: So the EPU does not
12 significantly change the peaking factors or anything?

13 MR. HUANG: I don't think so.

14 MR. MARCH-LEUBA: If anything it is flat
15 instead.

16 MEMBER BANERJEE: Yes, it flattens it.

17 MR. MARCH-LEUBA: So it makes it better
18 from the point of instability.

19 MEMBER SIEBER: Yes, it is a function of
20 the core load.

21 MR. HUANG: Sorry I missed that. ATWS
22 Instability here. Grand Gulf implemented EPG/SAG.
23 You know, it is a division, too, like Muhammad
24 presented in slides.

25 So once they get a signal from ATWS, then

1 that will be automatic recirculation flow runback.
2 And then with manual water level reduction, to about
3 two feet below the feedwater puncture, and then a
4 manual, they have a boron injection trip --

5 CONSULTANT WALLIS: The circ system?

6 MR. HUANG: The circ system, yes.

7 CONSULTANT WALLIS: This says manual?

8 MR. HUANG: Yes.

9 CONSULTANT WALLIS: So the operator can
10 fail to do it?

11 MR. MARCH-LEUBA: When you are in the
12 emergency operating procedures you rely on operator,
13 yes?

14 CONSULTANT WALLIS: So if they don't do it
15 --

16 MR. MARCH-LEUBA: If they don't do it,
17 they are not doing their job.

18 (Laughter.)

19 MR. MARCH-LEUBA: At least not during the
20 emergency.

21 CONSULTANT WALLIS: I know, I know.

22 MR. RAZZAQUE: They can do other things
23 wrong also.

24 CONSULTANT WALLIS: But this would seem to
25 be something they should not do wrong.

1 MR. MARCH-LEUBA: In the particular case
2 of Grand Gulf, the water level reduction happens
3 automatically because the fuel pump lose steam so you
4 really run out of injection water. It will drop.
5 Unfortunately, it will continue to drop unless they
6 restore water. And this happens in most plants, the
7 water level reaction is almost automatic. Not all of
8 them.

9 CHAIR REMPE: What are they using for
10 water level measurement? Is it the TP gauges?

11 MR. MARCH-LEUBA: Condensation has its
12 problems.

13 CONSULTANT WALLIS: So there is nothing
14 that detects unusual amounts of reactivity that forces
15 boron injection? It depends on the operator always.
16 There is nothing to back up the operator in the event
17 of an ATWS of boron injection.

18 MR. MARCH-LEUBA: No. Boron is manual in
19 every plant I know.

20 CONSULTANT WALLIS: Okay.

21 MEMBER BANERJEE: But for ATWS there is a
22 lot of operator actions needed.

23 MR. MARCH-LEUBA: Yes.

24 MEMBER BANERJEE: So this is just part of
25 the whole suite.

1 MR. MARCH-LEUBA: In your own design
2 basis.

3 MEMBER BANERJEE: Yes, it is not a design
4 basis.

5 MR. MARCH-LEUBA: Even for an ATWS, the
6 most likely scenario is boron will never get injected
7 because you will find alternate way of putting the
8 rods in. That is what the operators are doing for the
9 first five minutes, is trying to put the rods in
10 because they know that the rods work and boron takes
11 a long time.

12 So one operator just goes to a corner, he
13 is over there manually tending to put the control.
14 That is the best operator in the room. I mean that is
15 the guy 100 percent full-time just working on that.

16 MEMBER BANERJEE: You know, we should
17 actually go and see this sometime.

18 MR. MARCH-LEUBA: I strongly recommend it.

19 MEMBER BANERJEE: Yes. Because we hear
20 all this stuff and we have never actually gone through
21 the drill.

22 MR. MARCH-LEUBA: And if you do go,
23 remember take sufficient time to see it four or five
24 times. Because those first two minutes fly.

25 (Laughter.)

1 CONSULTANT WALLIS: Someone has to say we
2 have an ATWS.

3 MR. MARCH-LEUBA: They do. They do. That
4 is the responsibility of one of the operators and as
5 you will see on the next slide, it takes 11 seconds to
6 do that.

7 MR. KRUPA: This is Mike Krupa. Can I
8 just make a statement? I'm from Entergy.

9 Like they say, the EPGs and the
10 significant accident procedures that are in place and
11 the control room operator trying and that they go
12 through every five weeks drives this command and
13 control and actions. It is their flow charts that
14 they manually go through for place-keeping that
15 dictates these actions. It is not if they remember.
16 It is not -- It is very structured, very controlled in
17 both training and program.

18 MR. MARCH-LEUBA: Yes, and human factors
19 is involved in there. And they have very nice flow
20 charts. All of the EPGs are, the operator does not
21 have to think. They are driven by actual
22 measurements. If the water level is below this point,
23 thou shall do this. You don't have to think of what
24 pumps are operating, what valves are open. If the
25 water level is going down, you need to put water in.

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1 That is the type of the EPG. You should look at the
2 flow charts.

3 MEMBER BANERJEE: So how is the decision
4 made to inject boron? What is the basis? If they
5 can't drive the rods in, something happens?

6 MR. MARCH-LEUBA: The decision to inject
7 boron has nothing to do with that.

8 MEMBER BANERJEE: Okay.

9 MR. MARCH-LEUBA: It is action-based. You
10 have a heat capacity temperature limit curve, which
11 tells you that you are overheating the containment.
12 Whenever you hit a point in which there is no return,
13 then you need to start putting boron.

14 So it is driven by a temperature in the
15 containment. So if your containment reaches 110
16 degrees, typically, press the button.

17 MEMBER BANERJEE: Okay.

18 MR. MARCH-LEUBA: So it doesn't ask what
19 other systems you could have been using.

20 MEMBER BANERJEE: Right.

21 MR. MARCH-LEUBA: If you are overheating,
22 press the button.

23 MEMBER BANERJEE: Okay.

24 MEMBER SKILLMAN: Jose, Dr. Rempe asked
25 you a question about water level instrumentation.

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1 Would you explain again your answer?

2 MR. MARCH-LEUBA: It has several taps on
3 the vessel and it has some lines. And at the end of
4 those, there is a delta P that gives you the changing
5 pressure within two elevations. And that gives you
6 the water level.

7 MEMBER SKILLMAN: Is there a reference
8 light?

9 MR. MARCH-LEUBA: I don't know the
10 details. You had better ask the real engineers. What
11 they said there is problems, especially in the deepest
12 recessions, you are sure what the reference leg is
13 doing.

14 MEMBER SKILLMAN: I would like to pursue
15 that. I would like to know what is filling the
16 reference leg. So I would like to know how the
17 operators know for certain what their water level is.

18 MR. MARCH-LEUBA: You better ask an
19 expert.

20 CHAIR REMPE: I think we have someone back
21 there.

22 MR. PAPPONE: This is Dan Pappone, with
23 GE-Hitachi. The reference leg is filled with, there
24 is a steam line coming up to a condensing chamber at
25 the top of the leg. The condensate fills the

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1 reference leg and I believe all plants now have gone
2 to a backfill system where they take clean water from
3 the control rod drive system at the pressure and
4 trickle that through the reference site to make sure
5 that it is all flushed out. So that keeps -- that
6 assures that the reference leg is filled and assures
7 that you don't have to develop gases that could come
8 out solution if there is a pressurization.

9 CHAIR REMPE: So power is required for
10 this backfill system?

11 MR. PAPPONE: Yes.

12 CHAIR REMPE: And there is usually
13 different water level gauges. And these are the ones
14 that are in the core region, as opposed to -- they are
15 calibrated for a particular region. Right?

16 MR. PAPPONE: They are typically in plant
17 like Grand Gulf there will be four reference legs for
18 the normal water level divisions that are serving as
19 a reference column. There will be two taps for
20 narrow-range level instrument and wide-range
21 instrument and then there is also another tap coming
22 off of jet pump diffuser that provides water level
23 indication in the fuel zone range.

24 CHAIR REMPE: Does that answer your
25 questions or did you want more information?

1 MEMBER SKILLMAN: Well it sounds great on
2 paper. What I am really pursuing here is you stop
3 flow, it is automatic overflow. You stop feedwater
4 you said. So what assurance do the operators have
5 that their reference legs are not flashing due to the
6 pressure fluctuations?

7 MR. MARCH-LEUBA: At this point when the
8 operator is supposed to reuse water level, you don't
9 have such a significant pressurization. You have the
10 range of the SRV actuation. So you have gone from
11 1000 psi to roughly 1100 and you are oscillating what
12 50 psis. The problem with flashing occurs when you
13 depressurize and go down to 50 psi.

14 So at this point, I am not worried about
15 flashing. At the end of the transient, after you have
16 depressurization and you are below let's say 100 psi,
17 then you definitely have to worry a lot about it. And
18 that is where they have all this back-flash and they
19 try to flush those gases from the reference lines
20 before it actually happens. Those gases have
21 accumulated over months of operation. In normal
22 operation they flush them so that doesn't happen.

23 MEMBER SKILLMAN: Have these, if you will,
24 flash-off protectors been tested and confirmed to be
25 effective for their functional requirement?

1 MR. MARCH-LEUBA: I don't know. Anybody?

2 MR. PAPPONE: This is Dan Pappone. We
3 implemented the back fill systems I believe in the
4 earlier or mid-1990s when we were having issues with
5 plants. As they were coming down in pressure there
6 would be the flashing. They would see a notch in the
7 water level. I have not -- I am not aware of any of
8 that happening recently since the system has been put
9 in place.

10 MEMBER SKILLMAN: Thank you.

11 MR. HUANG: All right. We'll continue for
12 this ATWS instability. You know, this Grand Gulf the
13 main source of high pressure injection is feedwater,
14 about 100 percent steam driven.

15 So they say Grand Gulf requires partial
16 depressurization to use the motor-driven condensate
17 storage pumps because they say 100 percent of
18 feedwater is steam-driven. So that to make the point.

19 The next one would be the staff audit.
20 The staff audit would be review the EOP and their tech
21 specs. And staff reviewed the DSS-CD implementation
22 plan. Actually they provide there on the site. And
23 the staff also reviewed their ATWS performance in
24 simulators. There are two different scenarios from
25 two different initial conditions; one is turbine trip

1 ATWS at beginning of the cycle and the middle cycle.
2 And the second one with the main steam line isolation.
3 Main steam isolation, volume isolation, ATWS situation
4 at both the beginning and the middle cycle.

5 And at Grand Gulf at that time of the
6 staff audit they decide they don't have the EPU
7 condition. So following that, they run the same
8 situations. They provide additional information under
9 that EPU conditions. So staff had those and we update
10 our evaluation and in the slide we show that they
11 update EPU condition for that ATWS instability. Next
12 slide, please.

13 MEMBER SKILLMAN: Let's go back to 33,
14 please. I want to pursue the previous line of
15 questioning. The bottom bullet.

16 MR. HUANG: Yes.

17 MEMBER SKILLMAN: To provide feedwater,
18 you are going onto to your motor-driven condensate and
19 you are going to drop perimeter pressure, 500 psi.
20 What is T-sat and P-sat to those condensing gizmos
21 that are supposed to keep the reference legs fill,
22 please?

23 I would like an answer to that question.
24 If you are going to drop 500 psi, I believe you
25 probably drop below saturation pressure and I'll bet

1 you have got flash in that instance.

2 MR. MARCH-LEUBA: I believe you are right.

3 MEMBER SKILLMAN: In which case, I think
4 the operators now have nothing on level. It is all a
5 mystery until those reference legs refill.

6 MR. MARCH-LEUBA: They have a large
7 uncertainty level.

8 MEMBER SKILLMAN: A large uncertainty or
9 nothing.

10 CONSULTANT WALLIS: So how hot are these
11 reference legs?

12 MR. PAPPONE: This is Dan Pappone again.
13 The reference legs are routed so that the vertical
14 drop is outside of the drywell. That limits the heat-
15 up.

16 CONSULTANT WALLIS: So they are cold,
17 aren't they?

18 MR. PAPPONE: And they are cold. They are
19 cold reference legs. There is a short section in the
20 drywell, sort of a short vertical distance where if
21 you do have heating in the drywell, you could
22 conceivably have flashing when you do depressurize.
23 Emergency procedures also have the temperature curves
24 for when you expect that to happen for the reference
25 legs. So the operator is warned of this potential.

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1 CONSULTANT WALLIS: The main concern is
2 not the steam. It is the gases. The main concern is
3 dissolved gases coming out because of pressure drop.
4 Because you don't get low enough to reach T-sat.

5 MEMBER SKILLMAN: Well what can happen is
6 the gas can come out solution. You may get a level
7 change as a consequence of the overpressure of that
8 gas and now that your reference is inaccurate compared
9 to what is the true hydraulic level on the core.

10 I had this happen in New York City at
11 power. So I understand what this is. And I will tell
12 you it is very frightening to the operators because
13 they are, for a number of minutes, blind. And their
14 real role is to keep the core covered.

15 So I am curious about this. I would like
16 to know the relationship between P-sat, T-sat, and
17 this minus 500 psi to get the emergency or the motor-
18 driven condensate pumps online because that is your
19 source of feedwater, your new source of feedwater.

20 MR. MARCH-LEUBA: Can somebody take an
21 action item to provide that temperature?

22 MR. FORD: Yes, and this is Brian Ford,
23 the Senior Licensing Manger. Just a couple points of
24 clarification.

25 You have one issue over potential flashing

1 as we come down in pressure. And I think that answer
2 goes to the fact that the reference leg is located
3 outside the drywell but we will confirm that.

4 MEMBER SKILLMAN: Maybe. We may.

5 MR. FORD: Yes, so we need to confirm
6 that.

7 The other issue is the one that is
8 currently addressed by the backfill systems that were
9 talked about earlier. That was something that was put
10 in for a phenomenon known as water level indication
11 notching that was an issue in the early '90s. And
12 that happens at even lower pressures. And it is when
13 the gases come out, generally as you are shutting
14 down, but you would basically see a sudden change and
15 then it would restore down to the previous level. So
16 you would basically see notches as the gas came out.

17 As was said by GE, most plants implemented
18 this system to put in clean water to basically flush
19 the gases out of the solution. There are a few plants
20 that use other solutions to deal with that.

21 MEMBER SKILLMAN: I'll be looking for some
22 feedback, please. Thank you.

23 CHAIR REMPE: Also on slide 34, could you
24 elaborate about specific EPU modifications that were
25 implemented in the simulator? What exactly was

1 changed?

2 MR. MARCH-LEUBA: The simulator -- you
3 will have to ask the simulator guys. But in general,
4 the simulator tracks every change to the facility. So
5 for example, in the control room they installed the
6 PRM, the power range monitor. They installed a PRM on
7 the simulator. All of the setpoints now, instead of
8 being at 100 percent power, you are now at 115 percent
9 power. You have to change all those setpoints. Boron
10 concentration, they change it in the plant, they
11 change the simulator. It is a big full-time job to
12 keep the simulator be the same as the control room.

13 And I can tell you that we were there in
14 October doing this audit and we were begging to let us
15 run some EPU conditions. Yes, increase the power to
16 115 and let's run it. They said no, this is not done.
17 And it took them three months to implement that.

18 CHAIR REMPE: Okay.

19 MR. MARCH-LEUBA: So the EPU, I mean, we
20 had to do the audits first on the old TP and then we
21 need the EPU after they have done all those changes.

22 CHAIR REMPE: Okay, that makes sense. I
23 didn't catch on the nuance that you had to do it
24 before the EPU changes were put in. Okay.

25 MR. MARCH-LEUBA: Well the simulator is

1 not required and the plant is not required to have all
2 the EPU changes until next month when they start the
3 EPU.

4 CHAIR REMPE: Okay.

5 MR. MARCH-LEUBA: And indeed, they don't
6 change it ahead of time. They change it as the
7 control room changes, the simulator matches.

8 CHAIR REMPE: Okay.

9 MR. MARCH-LEUBA: Dr. Banerjee was saying
10 that you should go see it. I mean, you really should
11 go see it.

12 CHAIR REMPE: I would like to.

13 MR. MARCH-LEUBA: It is really impressive.

14 CHAIR REMPE: Okay, thank you. And so
15 anything you wanted to add or did he cover the changes
16 that were important?

17 MR. BROADBENT: Yes, this is Greg
18 Broadbent. Basically he did cover the changes. There
19 are changes also to the core model as well. Make sure
20 that it corresponds to the EPU core and, like he said,
21 all the physical changes, the PRNMS and all have to be
22 updated and then we can get the operators trained so
23 that they are trained in advance to be able to operate
24 the EPU core and all the new systems that EPU has
25 introduced.

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1 MR. MARCH-LEUBA: They were showing
2 earlier a picture of the control room. I have never
3 been in the Grand Gulf control room but I have been in
4 the simulator. You cannot see the difference. You
5 are there. Other than there is a table with a
6 professor there, that is the only difference. Every
7 single key, every single knob, every single display is
8 in there.

9 MR. HUANG: Okay, so now this is BW-6 ATWS
10 performance. The Grand Gulf has BWR-6 specific ATWS
11 characteristics. So they are operate following that.
12 You know, they only high pressure injection in the
13 feedwater, which is 100 percent steam driven. We
14 already talked about that.

15 And then ATWS procedure call for partial
16 depressurization about 500 psi to use the motor-driven
17 condensate storage pump. And then the boron injection
18 is through the core spray and a faster response.

19 Also the Mark III, they have containment,
20 large heat capacity. So this is the nature of that.

21 Then the next one we do on the simulators.
22 And we picked up example for showing the staff,
23 showing that the ACRS member and then we have mock
24 event if you want to know, we have more for this. So
25 they can have more on this.

1 CONSULTANT WALLIS: Minutes and seconds?

2 MR. HUANG: This is a second here.

3 Minutes and seconds, yes.

4 MR. MARCH-LEUBA: I was the recorder of
5 record for this one in particular. And I have my
6 phone set on a stop watch. So those numbers are
7 recorded by me on my logbook.

8 We do have an audit report with all this
9 simulator runs we run and it is a 300-page report,
10 which you probably have it in the record. We only
11 wrote two pages. The other 298 are the source of the
12 simulator. And one thing you see there is everything
13 that the simulator does, every single alarm, every
14 single action of operators, every single automatic
15 action, we have the listing there. And you are
16 talking for an hour scenario, 25 pages of the small-
17 font actions.

18 So before Dr. Wallis asks his standard
19 question of how accurate the simulator product is, let
20 me preempt you and tell you that there are two
21 families of cores. You have the high-fidelity
22 engineering simulators. We can disagree which cores
23 are high-fidelity but let's call it TRACE, RELAP,
24 TRACG, RAMONA, which model very accurately the details
25 of everything inside the core. However, they model

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1 everything around the core mostly as boundary
2 conditions, including the operator actions.

3 Simulators are the other end of family of
4 this, they are completely different family of other
5 codes in which the details of the reactor of the
6 physics are a little fuzzy but you monitor all the
7 conditions correctly. You have every single auxiliary
8 system and every single operator action monitored.

9 So between the two we get an idea of what
10 is going to happen. The only thing on the simulator
11 is you will get the expected transient, not the
12 conservative transient. So we often used to see that
13 the transients run by TRACG and you are the simulator
14 and nothing happens. Well that was a very
15 conservative calculation with seven SRVs of there and
16 the rods didn't go in. In real simulator the rods
17 went in and we had all of the SRVs open.

18 So as I said, if you go into the simulator
19 and when the operator says or well the teacher says we
20 are going to start ATWS at a random time, he pushes
21 the button and in you go. And every single light
22 comes on. It looks like a Christmas tree and all the
23 alarms go on.

24 So the middle of the three operators which
25 were just minding their own business, each one jumps

1 to their own panel.

2 CONSULTANT WALLIS: He tells them ahead of
3 time they are going to have an ATWS?

4 MR. MARCH-LEUBA: No. They always tell us
5 they suspected it but we don't tell them which event
6 they are going to have ahead of time.

7 And they have to recognize what the event
8 is. And it is amazing because within ten, eleven
9 seconds one of the operators comes in, we have an MSRV
10 closure, reactor still has power.

11 So the senior operator has to go get the
12 right chart from the wall and put it on top of the
13 table and this is his flow chart. And he says I
14 should have a scram and the reactor still has power.
15 I am on branch three of this. And he starts giving
16 orders.

17 Now all of this takes roughly a minute.
18 And the first operator in this particular case took a
19 minute and 30 seconds and reheated the automatic
20 depressurization system, which is a LOCA event. And
21 in case of power loss, you don't have to have the
22 automatic depressurization.

23 CONSULTANT WALLIS: So these operators go
24 from doing nothing exciting and in 11 seconds they
25 know exactly what they have to do?

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1 MR. MARCH-LEUBA: Their adrenalin is
2 pumping. When every single --

3 CONSULTANT WALLIS: They must be young or
4 something.

5 (Laughter.)

6 MR. MARCH-LEUBA: I don't know if you have
7 been in power plants 20 years ago. When you walked
8 into a room, every single light will be flashing. And
9 that was just normal because that meant that somebody
10 was working on something.

11 Now they use this method of everything is
12 black. Once they have acknowledged it, it is not
13 there anymore. When those tiles light up and the
14 alarms go, the adrenalin is pumping. They jump. And
15 they have the procedures to follow and recognizing
16 that they are directors of power and your pressure is
17 rising is the first thing they do.

18 So as I said, within a minute and a half,
19 the operator, the senior operator knew where he was
20 and started giving orders. The next was to inhibit
21 ADS. Then he wanted to override the HPCS, high
22 pressure core spray system, because that is not an
23 allowed method to control level. That one is to
24 revert from LOCA also.

25 And it took about two minutes to terminate

1 feedwater. And again, look at this range. It asks
2 the operator to establish level control between minus
3 70 and minus 161 inches. And this is minus 70 is two
4 feet below the sparger. Minus 161 is the steam
5 cooling water level. So the operator just keeping
6 within this, what are we talking, 120 inches,
7 basically keeping below the sparger so you can preheat
8 the feedwater and condenser steam as it comes into the
9 vessel, keep it at the minimum steam water level and
10 we will be fine.

11 When they run out of steam in the
12 feedwater to maintain level control over the
13 depressurization to about 500 psi, so they start to
14 control the pressurization by blocking SRV balls.

15 And in this particular time, he saw that
16 what we were hitting the containment and there was no
17 way to recover, so within four and a half minutes, he
18 ordered the initiation of boron manually.

19 In a real ATWS -- we asked the professor
20 to not allow any control to go in. In a real ATWS, in
21 a real scenario for these four minutes, an operator
22 will have been -- well first he will have tried the
23 alternate rod insertion, which is drywell the rods
24 together. And if that didn't happen, they would have
25 tried one rod at a time pushing them and start putting

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1 one in at a time. So in a real ATWS, probably a SLC
2 would not have come in. They would have inserted two,
3 three, four rods. The operator would see that that
4 was working and I am going to achieve shutdown faster
5 with control rods than with boron.

6 Within seven minutes, we have reached the
7 500 psi, feedwater has been restored then, and then
8 the order to control between 350 and 500. Again, you
9 don't need to know all this instrumentation that
10 accurately. They have wide ranges. Within 150 psi is
11 okay. And if you look at a transient, truly volumes
12 are just jumping up and down that much.

13 It is hard to control water level,
14 especially by hand. It is difficult. There is lots
15 of delaying. And since this happened recently last
16 year, we were interested in the hydrogen igniters and
17 that took about 12 minutes to order the, to pull the
18 igniters.

19 And about 12 - 13 minutes, the transient
20 was essentially over and suppression pool cooling was
21 maximized.

22 Here is some eye candy of what we were
23 seeing. The picture on the left is the flux, APRM
24 flux. The picture on the right is the pressure. And
25 you see that right here there was an MSIV closure and

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1 you have the instantaneous pressure drop in the power
2 transient, followed by the pump, restoration pump run
3 down, which gives you a power about this way. And
4 every so often an SRV opens and closes. And every
5 time an SRV closes, it puts a big pressure transient.
6 That gives you operation response.

7 Eventually, boron comes in and you shut
8 down. If you have the pressure this, you have the
9 MSIV closure, pressure falls, after 1400 psi in this
10 case, and then the SRV is cycling. And eventually
11 they lock open SRVs and they pressurize to regain
12 control of it.

13 In this particular scenario, we reach 180
14 degrees F on the suppression pool temperature. And
15 this is boron started coming in at 400 seconds and it
16 very rapidly entered into the core because in BWR-6s
17 we inject boron into the core so you don't have any
18 specification and it is very effective.

19 And again, in this other report you have
20 like five or six more transients that you would be
21 interested in.

22 MR. HUANG: Yes, so this is a summary of
23 the review on this Grand Gulf stability and ATWS
24 stability. And EPU operation is acceptable from
25 stability point of view, when they installed the long-

1 term Solution III it provide similar level of the
2 protection under EPU and original licensed thermal
3 power. Because right now they would be that the
4 section three under power range neutron monitoring
5 system. And the OPRM scram satisfies the GDC 10 and
6 12 requirements.

7 And then ATWS and ATWS-Stability not
8 affected significantly by EPU. And they satisfy ATWS
9 acceptance criteria 10 CFR 50.62. And the Grand Gulf
10 requires partial depressurization to use the
11 condensate storage pumps. And also it showed that in
12 the simulator heat capacity temperature link is not
13 compromised during the transient.

14 And that last one, Grand Gulf operator can
15 manage an ATWS event successfully and implement the
16 EOPs within the assumed timing, so that based on the
17 staff audit and the review it has come to our
18 conclusion.

19 MR. WOOD: Okay, my name is Kent Wood. I
20 am a Reactor Systems Engineer doing spent fuel pool
21 criticality reviews.

22 For every power uprate we are required to
23 make a post EPU conclusion that we continue to meet
24 general design criteria 62, which is prevention of
25 criticality events, handling of criticality events.

1 The licensee submitted to their application citing
2 this methodology in NEDC-33004, but it has nothing on
3 General Design Criteria 62. So we asked some
4 questions on how they were meeting General Design
5 Criteria 62. Their analysis of record relies on the
6 Boraflex. They mentioned that earlier.

7 Boraflex degrades. To accommodate that,
8 they had divided their spent fuel pool into two
9 regions, an all-cell region and a ten out of six
10 storage configuration requiring empty cells. An
11 analysis had not been submitted so we never had a
12 chance to review that.

13 So it is a complicated analysis that we
14 weren't going to be able to get done in time for
15 today's meeting. So we implemented a spent fuel pool
16 license condition. That license condition for Region
17 1, which is the all-cell region, they are still
18 crediting Boraflex. We limit that to a minimum areal
19 density, B-10 areal density in the boraflex of 0.0179
20 grams per centimeter squared, with a gamma dose of 2.3
21 in the tenth and a standard core cooling geometry
22 infinity limit of 1.26. Those are all numbers that
23 the applicant said that their Region 1 was good down
24 to areal density as low as 0.0167. We believe this is
25 conservative because we have moved that up a little

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1 bit on them to get us until we get the final analysis
2 done. The Region 2, which is the ten out of six with
3 six empty spaces in a four by four array. You see we
4 ratcheted down the standard cool core geometry k
5 infinity number from 1.26 to 1.21 for storage in that
6 configuration to account for the potential misloading
7 events until we get that finalized.

8 And there is a time limit on this license
9 condition to get all this done and that is limited in
10 their cycle, Cycle 19 for them.

11 MEMBER SKILLMAN: What is a cycle length,
12 Ken, 24 months or 12 months?

13 MR. WOOD: I think they are on 18 cycles.
14 Is that true?

15 MR. SMITH: We are licensed for 18 months
16 right now. That is correct.

17 MEMBER SKILLMAN: Thank you.

18 MR. SMITH: But we are in transition. So
19 it will be approximately 24 months. This is Fred
20 Smith speaking.

21 MEMBER SKILLMAN: So you are presently at
22 18.

23 MR. SMITH: We are licensed for 18. We
24 are transitioned to 24. We expect to submit to 24 and
25 we are planning to operate to 24.

1 MEMBER SKILLMAN: And will you be on the
2 24-month cycle for --

3 MR. SMITH: I don't whether 19 will be 24
4 months.

5 MEMBER SKILLMAN: Okay. And when does
6 Cycle 19 begin?

7 CHAIR REMPE: Next week.

8 MR. SMITH: Next week.

9 MEMBER SKILLMAN: So you are in a 24-month
10 fuel cycle right now. You expect to be.

11 MR. SMITH: That is our operating plan,
12 yes.

13 MEMBER SKILLMAN: Okay, thank you.

14 CONSULTANT WALLIS: If you want a
15 question, you could explain what an SCCG is.

16 MR. WOOD: It is stands for standard cool
17 core geometry.

18 CONSULTANT WALLIS: It looks like a big
19 number.

20 MR. WOOD: Well that is what that fuel
21 assembly would have, again, the core at cold
22 conditions.

23 CONSULTANT WALLIS: If it didn't have the
24 Boraflex or what?

25 MR. WOOD: Well I mean that is actually a

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1 core number.

2 CONSULTANT WALLIS: It is a core number.

3 MR. WOOD: And then there is a translation
4 from the --

5 CONSULTANT WALLIS: If you take it out,
6 you say nothing about what happens in the pool.

7 MR. WOOD: Well there is a translation --
8 part of the analysis is translation time.

9 CONSULTANT WALLIS: It takes time to get
10 there, all kinds of things.

11 MR. WOOD: Well I mean because that number
12 would translate down into probably a 0.95 or less
13 number in the pool because of geometry rangings and
14 everything else in racks.

15 CONSULTANT WALLIS: It is a very indirect
16 way of saying what is happening in the pool itself.

17 MR. WOOD: Yes, and that is part of the
18 analysis to make that correlation.

19 MEMBER ARMIJO: Are there any plans to
20 repair the degraded Boraflex?

21 MR. WOOD: I don't believe that they have
22 any plans to repair the degraded Boraflex. I don't
23 know how they would do that. Perhaps that is a
24 question for the licensee.

25 MEMBER ARMIJO: Other people have.

1 MR. WOOD: Well nobody has actually
2 repaired the Boraflex. People have done other things,
3 inserts and things.

4 MR. SMITH: This is Fred Smith from
5 Entergy. At this time, we have two regions. The
6 Region 2 does not credit Boraflex at all. As time
7 progresses, that region will get larger and it will
8 become increasingly uneconomic to sustain and so we
9 would look at options for either insert shims, a
10 number of people have done that, or potential re-rack.

11 MEMBER ARMIJO: So it is doable. You just
12 don't need to do it yet.

13 MR. SMITH: That's correct.

14 MEMBER ARMIJO: Okay.

15 MR. SOM: Good morning. My name is
16 Swagata Som from Electrical Branch.

17 The station blackout. Grand Gulf is a
18 four-hour coping plant and its design is based on the
19 ac-independent approach. Therefore, their design
20 relies on the Class 1E battery capacity, and
21 compressed air capacity, and other important stuff
22 that I have bulleted there.

23 Major characteristics. The condensate
24 inventory that had been verified for decay heat
25 removal and we find that there is a liquid capacity

1 margin. Class 1E battery capacity, they have not
2 added any additional load. So that is a bounding
3 condition.

4 Compressed air capacity, the air operated
5 valves will have sufficient compressed air for
6 operation and the effects of loss of ventilation
7 temperature-wise have also been evaluated and
8 assessed. And the areas are control room, control
9 cabinet area, and cable spreading room in-between, and
10 reactor core isolation cooling pump room, steam
11 tunnel, switchgear and inverter room, and drywell all
12 have adequate bounding condition.

13 Containment isolation, there is also no
14 adversely affected for SBO event for EPU so we can
15 summarize that the EPU conditions will not adversely
16 impact the landscape related to mitigate the
17 consequences of a station blackout. That is all.
18 That is brief.

19 CHAIR REMPE: So we are about 15 minutes
20 early. And do you want to go ahead and do the power
21 range neutron monitoring system or do you guys want to
22 have -- Let's push on. If it says 15 minutes, I think
23 we can do it. Do we have the staff here?

24 MS. LUND: We have them.

25 CHAIR REMPE: Do you want to go ahead and

1 do that?

2 MR. DITTMAN: Good day. I'm Bernard
3 Dittman, Reactor Technical Reviewer for the Office of
4 Nuclear Reactor Regulation, Office of Engineering,
5 Instrumentation, and Control Branch.

6 I will be summarizing the staff's review
7 of the Grand Gulf's Nuclear Station Power Range
8 Neutron Monitor Retrofit and the instrumentation and
9 control equipment that it provides. This review was
10 conducted as a separate licensing action from the
11 extended power uprate. And that was mentioned earlier
12 by the licensee.

13 Okay, the Power Range Neutron Monitor
14 Retrofit supports the EPU by providing the Oscillation
15 Power Range Monitor Option III stability trip
16 function. They identified General Electric Licensing
17 Topical Report. This topical report was previously
18 reviewed and approved by the staff.

19 The modification applies General Electric-
20 Hitachi Nuclear Measurement Analysis and Control
21 digital components to replace analog components in a
22 manner similar to other licensee retrofits that were
23 based on the same licensing topical report.

24 The modification includes safety and non-
25 safety equipment that are installed in the control

1 room, which is a mild environment.

2 Based on the current regulations, the
3 staff's instrumentation and control review used
4 applicable regulatory guidance in effect at the time
5 of the license amendment request. This set of
6 guidance includes the Standard Review Plan Chapter 7,
7 Regulatory Guides, Branch Technical Positions, and
8 Digital Instrumentation and Control Interim Staff
9 Guidance, where some of this guidance had been created
10 or revised since the earlier staff review of the
11 licensing topical report.

12 The Grand Gulf Power Range Neutron Monitor
13 equipment configuration meets the independence
14 requirements for electrical power sources, electrical
15 isolation, and reliance upon sources that originate
16 within the channel's safety division to satisfy the
17 single-failure criteria.

18 There are four independent Power Range
19 Neutron Monitor channels. Two Power Range Neutron
20 Monitor channels are assigned to each of two
21 electrical safety divisions.

22 Each Power Range Neutron Monitor channel
23 is powered from a 120-volt alternating current under
24 an interruptible power supply within its electrical
25 safety division.

1 Each Power Range Neutron Monitor channel
2 processes sensors dedicated to the channel to create
3 independent trip votes. And each Power Range Neutron
4 Monitor channel contains a two-out-of-four voter to
5 independently perform coincidence logic on all
6 channels' trip votes.

7 This figure shows the configuration of the
8 Power Range Neutron Monitor channels, as described by
9 the previous slide, and depicts the electrical
10 isolation provided between divisions for analog
11 signals, such as sensors and relays.

12 Each Power Range Neutron Monitor channel's
13 voter output provides an input to the corresponding
14 portion of the reactor protection system's one-out-of-
15 two taken twice logic. The reactor protection system
16 was not modified as part of this retrofit.

17 Interdivisional digital communication,
18 including safety, non-safety interfaces satisfies the
19 applicable staff positions of Digital Instrumentation
20 and Control Interim Staff Guidance 04. This slide
21 highlights Power Range Neutron Monitor design features
22 that address staff positions within this Interim Staff
23 Guidance.

24 This figure shows the overall digital
25 communication topology for the Power Range Neutron

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1 Monitor System by representing the two channels within
2 Electrical Safety Division A. The figures shows the
3 application of fiber optic point-to-point
4 communications, use of communication processors, and
5 the partitioning of non-safety functionality from the
6 safety function processors, as described on the
7 previous slide.

8 The licensee demonstrated that the
9 potential for software common-cause failures within
10 the Power Range Neutron Monitor System was adequately
11 addressed and no plant vulnerability exists.

12 The licensee performed its analysis per
13 Branch Technical Position 7-19 and it postulates a
14 complete simultaneous failure of all four Power Range
15 Neutron Monitor channels in conjunction with each
16 design basis anticipated operating occurrence and in
17 conjunction with each design basis accident.

18 The licensee's demonstration of compliance
19 to Branch Technical Position 7-19 justified no further
20 action to increase diversity or defense-in-depth.

21 The licensee also demonstrated compliance
22 to Digital I&C Interim Staff Guidance 02.

23 MEMBER SKILLMAN: Bernard, what does
24 bullet two tell us, please? Would you interpret that
25 for us, at least for me, please?

1 MR. DITTMAN: If when performing the
2 analysis per Branch Technical -- oh, bullet two.

3 Okay, the licensee's analysis assumed that
4 all four PRNMS channels would fail --

5 MEMBER SKILLMAN: Would fail, okay.

6 MR. DITTMAN: -- simultaneous with
7 individually every anticipated operational currents.
8 And they also performed the same analysis concurrent
9 with each design basis accident. And they showed
10 there would be no radiological release, no risk to
11 public health and safety because they have diverse
12 protected methods to mitigate an interoperable Power
13 Range Neutron Monitor.

14 MEMBER SKILLMAN: Thank you, Bernard.

15 CONSULTANT WALLIS: And the first bullet
16 is a qualitative thing, isn't it? There is no
17 quantitative measure of probabilities of anything.

18 MR. DITTMAN: No. No, it is all
19 determined --

20 CONSULTANT WALLIS: So if you have a
21 certain structure, then that is good enough.

22 MR. DITTMAN: Yes.

23 CONSULTANT WALLIS: Is there any
24 quantitative measure of these things available?

25 MR. DITTMAN: Currently the staff doesn't

1 endorse or recognize any quantitative software
2 reliability measure.

3 The conclusion that the Grand Gulf Nuclear
4 Power Range Neutron Monitoring System functions,
5 configuration, and architecture are consistent with
6 the prior General Electric Licensing Topical Report
7 and its staff evaluation. And Grand Gulf Nuclear
8 Station fulfilled the licensing topical report plant-
9 specific action items.

10 Therefore, the prior staff evaluation
11 conclusions were determined remain valid for the use
12 of the GEH NUMAC component designs and features within
13 Grand Gulf's application, which was a four-channel
14 system.

15 The staff also recognized that the
16 proposed technical specification changes for the four-
17 channel system was consistent with the topical report
18 and were acceptable.

19 The specification testing of the Grand
20 Gulf Power Range Neutron Monitoring System confirmed
21 that the I&C performance applicable to Grand Gulf Unit
22 1, for example, response time, environmental, seismic,
23 electromagnetic interference, radio frequency
24 interference, et cetera, are bounded by the
25 combination of General Electric's Licensing Topical

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1 Report and supplemental licensing efforts.

2 As addressed by the earlier slide, Grand
3 Gulf Nuclear Station demonstrated no adverse effect to
4 safety functions from non-safety equipment or from
5 interdivisional communications among Power Range
6 Neutron Monitor channels to satisfy applicable
7 portions of IEEE 603 and Digital Instrumentation and
8 Control Interim Staff Guidance 04.

9 As addressed by the previous slide, Grand
10 Gulf Nuclear Station adequately addressed software
11 common cause failure and diversity and defense-in-
12 depth to satisfy Branch Technical Position 7-19 and
13 Digital Instrumentation and Controls Interim Staff
14 Guidance 02.

15 Therefore, the proposed instrumentation
16 and control changes are acceptable because they meet
17 applicable regulations and satisfy current and
18 applicable I&C evaluation criteria, thereby providing
19 reasonable assurance of continued adequate protection
20 of public health and safety.

21 For your convenience, the last slide
22 spells out some terms that I may have not spoken out.
23 Thank you for your time and I will be happy to answer
24 any further questions.

25 CHAIR REMPE: Does anyone have any

1 questions?

2 Well I think then at this point, let's
3 have a recess for lunch and come back at 1:00 p.m. and
4 start up again.

5 (Whereupon, at 11:51 a.m., a lunch recess
6 was taken.)

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A-F-T-E-R-N-O-O-N S-E-S-S-I-O-N

(12:59 p.m.)

CHAIR REMPE: I would like to reconvene this meeting. And I believe the licensee has some questions they are going to answer before they go back to the regular agenda that were questions from this morning.

MR. KRUPA: Okay, the first -- Mike Krupa again. The first question Mr. Skillman asked is on the saturation depressurization issue for reference leg effect. The bottom line is the design of the reference leg system for the instrumentation fill level is not impacted by the reactor pressure. The system does have a keep-fill/purge that keeps the non-condensables out of the reference leg and is kept, it is pretty much an ambient temperature because of the CRD purge. And the overpressure has no impact so we have a curve for the operators in their EP plans that is basically a saturation curve stepped down a few degrees. And we can go from radiant pressure all the way down to zero, so a thousand pounds all the way to zero. As long as you are under 200 degrees in the drywell or containment you are not boiling your reference leg and you are not off gassing by design.

So the reference legs are basically

1 designed not to off gas. And what we give operators
2 direction and guidance for is for boiling. So we
3 watch the containment and drywell temperatures that
4 would impact the reference leg in those environments.

5 And so at those points, we would not use
6 those reference levels anymore and they have
7 additional guidance if they don't have level
8 indication.

9 MEMBER SKILLMAN: Thank you. I
10 understand. Got it.

11 CHAIR REMPE: And so this was a very fast
12 event. And do they actually go to those operator aids
13 for such an event like that occurrence?

14 MR. KRUPA: Oh yes. If we are in any
15 upset event, an accident condition or an off-normal
16 condition, they are immediately into their EPs and are
17 using those tables.

18 CHAIR REMPE: Okay. I have not been in
19 the control room. So are they part of the procedures
20 or where do they find these operator aids?

21 MR. KRUPA: They are right at the control
22 room supervisor's desk. I mean, they are kept right
23 there. So as soon as they have indication. You know,
24 the indications are actually, we were hearing them
25 described earlier in the ATWS discussion. If an alarm

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1 comes in, it is identified very clearly as one of the
2 entry conditions for an EP. And all the operators are
3 trained to recognize those. And so all of them,
4 everybody in the control room would call out that is
5 an EP entry. And they immediately pull out that flow
6 chart for that EP and start down that path. And these
7 guidance are right in those EPs.

8 CHAIR REMPE: Okay, thank you.

9 Do you have any more questions?

10 MEMBER SKILLMAN: No, thank you.

11 CHAIR REMPE: Okay. Is there another
12 issue you wanted to address?

13 MR. KRUPA: Well, I had a follow-up for
14 Mr. Schultz but --

15 CHAIR REMPE: He will be back here within
16 maybe ten, fifteen minutes.

17 MR. KRUPA: I will just defer that because
18 he asked the question. It would be better to do it
19 while he is here.

20 CONSULTANT WALLIS: Do you have anything
21 more on SRVs?

22 MR. KRUPA: Yes, we are going to bring up
23 SRVs here with the dryer presentation. Yes, during
24 the steam dryer.

25 MR. VERROCHI: I can speak to that. I

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1 thought that we do have a lot of the information we
2 need. This is Steve Verrochi, by the way.

3 We do have enough information for the SRVs
4 but I thought we would probably get into more the SRV
5 resonance and that would probably be the best. It is
6 also covered there.

7 MR. BURFORD: Good afternoon. My name is
8 Jerry Burford. I am the Manager of Licensing for the
9 EPU for Grand Gulf. And a topic was requested
10 regarding groundwater monitoring for Grand Gulf.

11 Over the last several years there have
12 been instances identified within the industry for
13 leakage, spills, abnormal tritium, or contamination
14 getting into the groundwater. This is precipitated in
15 the NRC issuing information notice back in 06 and
16 again just last month they issued 2012-05 to alert the
17 industry to the potential issue of groundwater
18 contamination.

19 This also resulted in the industry
20 mobilizing to address the issue of contaminated
21 groundwater and NEI has developed the Groundwater
22 Protection Initiative. It was issued in NEI 07-07 and
23 Entergy now has implemented that initiative at our
24 site.

25 As part of that implementation, we were

1 monitoring various wells around the site. In 2012,
2 May of 2010, we identified a well, a location where we
3 have higher than expected tritium. And with that,
4 then, when we made that discovery we initiated
5 detailed hydrological studies of the site, of that
6 particular area so that we could bound the spill and
7 make sure that we bound the area of the contamination
8 and make sure that we could assess the plan going
9 forward to address that.

10 MEMBER SKILLMAN: Jerry, what was the
11 origin of that spill?

12 MR. BURFORD: We have identified that
13 there are no process pipes in that are, buried in that
14 area. So there is no active leaks.

15 MR. PERITO: The spill was from a
16 temporary system that was set up on the east side of
17 the turbine building in relation to the truck pay that
18 was used for a temporary set up that communicated with
19 plant process and we believe the spill, the '97 spill
20 occurred in that are, the turbine building truck bay.

21 MEMBER SKILLMAN: Okay, thank you.
22 Thanks.

23 MR. BURFORD: I want to jump in and show
24 a map of the site area. This is a potentiometric map.
25 The blue line circling the power block area here are

1 actually lines of constant hydraulic gradient. We
2 would expect then that groundwater flow would be in a
3 direction perpendicular to these lines.

4 What we have here is the Unit 1 and
5 Turbine Building for Unit 1, the unfinished,
6 uncompleted Unit 2 and its Turbine Building. The area
7 of the spill, I am pointing, there is the DW-01 was
8 identified, the area of the spill was right in this
9 area where the truck log is. And this is the well
10 that we have identified the elevated tritium leakage.

11 So we are studying the migration of that
12 contamination and have identified that there is a
13 plume that is in the direction as expected. The
14 groundwater flow would be perpendicular to these
15 lines. We expect it to be coming in across the site
16 and going out this way.

17 And then not showing on this map but we
18 expect that the gradient actually bends around and
19 remains on the site property.

20 MEMBER BANERJEE: Where is the property
21 boundary?

22 MR. PERITO: The property boundary is not
23 shown on this. It is well beyond that.

24 MR. BURFORD: Well beyond, yes.

25 MEMBER BANERJEE: So it would come around?

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1 MR. BURFORD: It actually will come around
2 and there is --

3 MEMBER BANERJEE: That is the raised area
4 on the right?

5 MR. BURFORD: Yes.

6 MEMBER ARMIJO: What is the size of the
7 spill? Was it thousands of gallons, hundreds of
8 gallons?

9 MR. PERITO: Approximately 1500 gallons.

10 MEMBER ARMIJO: Fifteen hundred?

11 CHAIR REMPE: People didn't notice it at
12 the time?

13 MR. PAPPONE: Oh yes, it was noticed. It
14 was accounted for in the effluents monitoring report
15 in '97.

16 MEMBER SIEBER: How does the activity of
17 the plume compare to the drinking water standard in
18 magnitude?

19 MR. PAPPONE: We have not exceeded the
20 quarterly reporting of 20,000 picocuries per liter.

21 MEMBER SIEBER: So you could actually drip
22 the water and stay below the standard.

23 MR. PERITO: At this point, yes.

24 CONSULTANT WALLIS: So this was a one-shot
25 spill. This went out, I mean it spread.

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1 MR. BURFORD: That is correct.

2 MEMBER BANERJEE: And it is decaying away
3 at the time.

4 MR. PERITO: It is migrating. We are
5 getting different levels in some of the surrounding
6 wells. So we continue to work with the hydrologists
7 to understand the migration of this plume and to bound
8 it, make sure we understand where it is going,
9 understand what potentially we may do down the road
10 for any remediation.

11 CONSULTANT WALLIS: Does it eventually
12 cull around and go into the river?

13 MR. PERITO: It will eventually find
14 itself around the north side of the plant to the
15 river.

16 MR. BURFORD: It is decaying away. The
17 half-life of tritium is about 12 years.

18 MR. PERITO: So we are told from the
19 hydrologist's study that at this point where it is
20 they believe the migration is on the order of feet per
21 year.

22 MEMBER SKILLMAN: What other isotopes are
23 in that water?

24 MR. PERITO: There were no isotopes
25 associated with a process system that we have

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1 determined.

2 MR. BUCKLEY: Yes, this is Rick Buckley
3 with Entergy. We detected only radionuclides and only
4 tritium.

5 MEMBER SKILLMAN: Only tritium.

6 MR. BUCKLEY: Which is consistent with the
7 '97 spill, what was spilled to the environment.

8 MEMBER SKILLMAN: Thank you.

9 CHAIR REMPE: Okay, so it was reported in
10 '97 but there was no, -- they took whatever necessary
11 actions were required in '97 and it is just that the
12 requirements have gotten more rigid.

13 MR. BURFORD: It indicated the spill and
14 there wasn't -- the monitoring program hadn't picked
15 up until we had the Groundwater Initiative.

16 We are working with our hydrologists then
17 to develop detailed plans to continue to monitor this
18 area and ensure that we are bounding it and also that
19 our predictions as far as the flow path and the
20 expected migration path will actually circle the site.

21 So there are additional wells planned. We
22 have added 19 wells in the last couple of years,
23 again, to ensure that we are bounding this area and
24 able to assess the effects. And we plan additional
25 wells to be able to track the migration of the

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1 tritium.

2 And in summary then, the tritium discovery
3 was not associated with an active leak. We have no
4 process pipes in the area with potentially
5 contaminated fluid. The power uprate will not
6 adversely impact the contamination finding. And we
7 have, Entergy has communication protocols in place
8 with the state and local agencies. So we are
9 discussing this with them and keeping them informed of
10 the issue. And we are continuing then to work with
11 the hydrologists to ensure that we track this and are
12 able to ensure the appropriate mitigation.

13 CONSULTANT WALLIS: And if this goes on
14 the ground, doesn't it come up through tree roots and
15 things like that?

16 MR. BUCKLEY: Tritium is there.

17 CONSULTANT WALLIS: Yes, there are trees
18 there. They will presumably evaporate groundwater.

19 MR. BURFORD: Yes, I don't think that you
20 see that the groundwater, the tritium coming out back
21 up through the roots.

22 CONSULTANT WALLIS: Well the water comes
23 up through the roots. So --

24 MR. BUCKLEY: This is Rick Buckley from
25 Entergy. Tritium is very mobile and it is going to go

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1 down. It will be so far below the surface, there is
2 not going to be --

3 CONSULTANT WALLIS: So far below the
4 surface, okay.

5 MEMBER SIEBER: How far away is the
6 protected area from the river?

7 MR. PERITO: Our protected area includes
8 a portion of property right down to the river.

9 MEMBER SIEBER: Oh, okay.

10 MR. PERITO: The aquifer, this is a good
11 distance away from the site drinking water wells,
12 which are located on the far west of that diagram and
13 not in communication hydrologically-wise with any of
14 the town drinking supplies. So we are just watching
15 its migration at this point.

16 MEMBER SKILLMAN: Where are these big
17 wells we saw pictures of? This morning we saw
18 pictures of whatever they are called, these wells that
19 go down.

20 MR. PERITO: The radial wells.

21 CONSULTANT WALLIS: The radial wells.

22 MR. BURFORD: Those are on the far left.

23 CONSULTANT WALLIS: So they are not
24 involved with this at all.

25 MR. BURFORD: No. They are along the

1 river.

2 MR. KRUPA: This is Mike Krupa. The
3 plant, the picture of the -- I'm sorry.

4 The picture of the plant there that Jerry
5 is pointing to is basically the protected area of the
6 plant that rest of the property is owner-controlled
7 and the river is about a mile west of the footprint of
8 the plant. The outfall for the site water would be
9 just worth probably about a quarter more, about a
10 quarter mile and it goes through sediment ponds
11 getting there but it is a good deal away from this, if
12 that was your question.

13 CHAIR REMPE: Okay, so if there aren't any
14 more questions on this topic, shall we go to the next
15 topic? Thank you.

16 MR. THORNTON: Okay, good afternoon. My
17 name is Thomas Thornton. I am the EPU Engineering
18 Manager. I am going to talk about mechanical impacts
19 as they relate to the reactor pressure vessel and the
20 reactor pressure coolant boundary.

21 One of the focus areas for the evaluation
22 of the reactor pressure vessel internals was the
23 structural adequacy of the components that are in the
24 steam and feedwater flow paths subjected to increase
25 flow-induced vibration loads.

1 Overall, there is very minimal impact for
2 Grand Gulf in this area, based on the analysis
3 performed. The evaluation methods used were
4 analytical methods that determined loads based on
5 fluid velocities and component structural behavior
6 determined by frequency characteristics, as well
7 analysis of available startup test data that we had
8 available from critical components.

9 One area that we looked at was with
10 respect to core flow. And as we stated previously,
11 the maximum core flow does not increase for EPU. The
12 recirculation pumps are constant speed pumps,
13 therefore, there is no change in vane passing
14 frequencies. And as such, all the flow-induced
15 vibration loads associated with core flow are not
16 changed in the components within the core. The guide
17 tubes that would be subjected to this do not see an
18 increase and these components remain acceptable.

19 The analysis of other reactor internals
20 that utilize the vibration data that was obtained from
21 startup testing was looked at with respect to EPU
22 conditions at 102 percent power level and 105 percent
23 rated core flow. And the results of this analysis
24 concluded that the loads on the RPV internals at EPU
25 meet the acceptance criteria that was established of

1 a 10 ksi for peak stress intensity, which is below the
2 ASME code values.

3 With respect to structural effects on RPV
4 internals, we are looking at RPV internals consisting
5 of the structural mechanical elements inside the
6 reactor. The effects of the EPU on the design input
7 parameters, the design basis loads and the load
8 combinations were evaluated for these internals at
9 both normal operation, upset, emergency, and faulted
10 conditions. Some of the effects include the pressure
11 differences on the components, thermal effects during
12 normal operation, and then transient pressure loads
13 associated with the design basis accidents and design
14 transient occurrences.

15 The internals included both the core
16 support structure components and the non-core support
17 structure components. The distinction being that the
18 core support structure components are the ASME code
19 components and the non-core support structures are
20 non-ASME code components. However, the requirements
21 of the code are used as guidelines in the design and
22 analysis.

23 The evaluations and stress reconciliation
24 performed on these components in support of EPU were
25 performed consistent with the design basis analysis

1 for the components. And as the design conditions were
2 not changed, except for the replacement of a steam
3 dryer within the reactor vessel which is evaluated
4 separately, the design conditions were considered
5 acceptable.

6 The evaluation of the replacement steam
7 dryer and its new design was found to not affect the
8 structural integrity of the reactor pressure vessel.

9 In addition, the stresses for the pressure
10 vessel internals emerged in faulted conditions are
11 governed by the operating dome pressure for the
12 vessel, which did not change for EPU. Thus, the code
13 requirements were considered to continued to be met
14 for all the components under emergency and faulted
15 conditions.

16 For the other loads, the increases were
17 evaluated. The critical and governing stresses were
18 determined by scaling the original stresses based on
19 the increase in loads. And the evaluation found that
20 all the stresses and fatigue usage factors are within
21 the ASME code allowable limits. And the components
22 remain structurally qualified for operation at EPU
23 conditions.

24 MEMBER SKILLMAN: Let me speak to that for
25 a minute.

1 MR. THORNTON: Okay.

2 MEMBER SKILLMAN: I think bullet three is
3 telling us that for a emergencies and faulted EPU you
4 meet the ASME III requirements. For normal and upset,
5 your loads have increased but still are covered by
6 Section III.

7 MR. THORNTON: Right. And it was those
8 loads that were scaled up for EPU conditions and the
9 stress is determined from those. What I was trying to
10 address was that primarily the design conditions do
11 not change and then the emergency and faulted
12 conditions don't change because they are driven by the
13 dome pressure values.

14 The other loads were scaled and those load
15 increases were evaluated.

16 MEMBER SKILLMAN: Thank you.

17 MEMBER ARMIJO: On your slide 36, you
18 introduced the IGSCC and IASCC. I have a couple of
19 questions on those topics.

20 MR. THORNTON: Okay.

21 MEMBER ARMIJO: The core internals that I
22 guess are of greatest concern are the top guide, core
23 support plate, and the shroud. And they all will get
24 a higher fluency --

25 MR. THORNTON: Correct.

1 MEMBER ARMIJO: -- as a result. And the
2 water chemistry will be affected by that increase in
3 flux as well. You will have more radiolysis, more
4 aggressive chemistry.

5 And I wanted to ask a question. Since you
6 do use hydrogen water chemistry, are you doing
7 anything to adjust your hydrogen input to maintain a
8 certain value for electrochemical potential to protect
9 those components?

10 MR. THORNTON: Yes. We have, in addition
11 to hydrogen water chemistry we have also implemented
12 online noble chemistry, online noble metals that are
13 injected with that. Along with that, we have the
14 electrochemical potential monitoring that we track
15 associated with that system and make sure that we
16 maintain the proper chemistry for those.

17 MEMBER ARMIJO: So if you find that at
18 higher power you actually are drifting off your
19 desired ECP, you would then adjust your hydrogen? Is
20 that your plan or are you just going to --

21 MR. THORNTON: Right. We are trying to
22 maintain that. Right now we have been able to reduce
23 the amount of hydrogen consistent with online noble
24 metal chemistry injection but yes, we are monitoring
25 the chemical potential.

1 MEMBER ARMIJO: Another thing. Last April
2 you reported an ultrasonic indication on a piping
3 system that connected to the pressure vessel in the
4 Residual Heat Removal System. And it was an
5 indication that wasn't confirmed whether it was an
6 IGSCC crack or a weld defect of some sort.

7 MR. THORNTON: Yes.

8 MEMBER ARMIJO: But if it was an IGSCC,
9 wouldn't that give you some concern about the
10 effectiveness of your hydrogen water chemistry or the
11 effectiveness of your initial inspection when the weld
12 was made somewhere along the line?

13 MR. THORNTON: Yes, that indication was
14 found in this most recent outage. We were completing
15 reexamination of our nozzles with the latest
16 ultrasonic testing techniques and found that
17 indication.

18 In looking at that and past reviews that
19 had been done on that, we were not able to determine
20 if that had been an existing flaw or not, based upon
21 the previous testing that was done. We looked at the
22 techniques that had been used previously and found
23 industry experience that showed those techniques were
24 not always as successful as the newer techniques,
25 which is why we were examining them with these

1 techniques.

2 So we feel like with the mitigation
3 techniques that we have in place currently with the
4 hydrogen water chemistry and the noble metals, in
5 addition those nozzles have all been had heat stress
6 improvements done to them, which we know are effective
7 in mitigating that. So we believe that is the only
8 indication that we have found and we have completed
9 examination of all of our nozzles at those
10 limitations.

11 MEMBER ARMIJO: Okay, thank you.

12 CHAIR REMPE: And this was the current
13 outage right now between April --

14 MR. THORNTON: Correct, that was this
15 year.

16 CHAIR REMPE: Okay.

17 MEMBER SHACK: Just a question. Do you
18 control to a potential or a hydrogen-oxygen ratio, for
19 your molar ratio for your chemistry?

20 MR. THORNTON: I am going to have to -- I
21 don't have that particular detail.

22 MEMBER SHACK: I thought I read somewhere
23 that you were committing to keep the hydrogen-oxygen
24 molar ratio to a certain level.

25 MR. THORNTON: Okay, we will have to

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1 follow up on that.

2 MEMBER ARMIJO: Unless they have improved
3 a lot, the ECP probes don't have a very good life.

4 MEMBER SHACK: Right.

5 MR. VERROCHI: This is Steve Verrochi. We
6 will take that question and make sure we get a
7 response back to you.

8 MR. THORNTON: Okay. This slide is
9 showing the fatigue usage factors for the limiting
10 location of components. Our evaluation, the
11 structural evaluation for the reactor pressure vessel
12 and the core support components looked at those
13 components that had the higher usage factors greater
14 than 0.50. For those that had the lower usage factors
15 or that did not see increases in the flow and
16 temperature or other mechanical loads, no evaluation
17 was required. These were the limiting locations that
18 were evaluated and the usage factors determined and
19 all were found to remain below the allowable 1.0.

20 I do note that we did have one nozzle that
21 was close to one with the original analysis performed.
22 That particular nozzle was reexamined. We looked at
23 the design cycles that were considered and compared
24 those to actual cycles that the nozzle had seen. And
25 also did finite element analysis of it to determine

1 the actual stresses on the nozzle location for that
2 analysis. And we were able with that new evaluation
3 to determine the lower cumulative uses factor.

4 MEMBER SKILLMAN: How do you know that you
5 are within the newly projected cycle's limitation for
6 that specific nozzle?

7 MR. THORNTON: Well we track those cycles
8 programmatically and keep up with those. That was how
9 we had the information available to go back and
10 reassess what was done, you know, originally and
11 extrapolate that over the life of the plant to ensure
12 that we are doing that, and then our tracking, to make
13 sure we maintain that.

14 MEMBER SKILLMAN: So this is your fatigue
15 monitoring program or your cycle assessment program.
16 How often do you assess that program? How often do
17 you update that data for that program?

18 MR. THORNTON: I don't know that I have a
19 good number. I know that it is done periodically. We
20 track them as they occur by procedure. And then that
21 data is collected and sent. I'm not sure if it is
22 every cycle but periodically we reassess it to reset
23 those numbers, confirm that we are remaining well
24 below what we consider for the lifetime.

25 And so that I mean that is how we have

1 been able to do it now. I'm sure over the life that
2 will have to increase as you get closer but we are
3 well below those cycles currently.

4 MEMBER SKILLMAN: Thank you.

5 MEMBER SHACK: Now is there any
6 environmental enhancement to these things or are these
7 strictly ASME code calculations?

8 MR. THORNTON: Environmental enhancement
9 --

10 MEMBER SHACK: Enhancement of the fatigue
11 usage factor.

12 MR. THORNTON: I'm not sure. Do you
13 understand?

14 MR. PAPPONE: I don't know. I understand
15 it. I don't know the answer offhand.

16 MR. THORNTON: Okay. We'll get some
17 information on that. Environmental considerations --

18 MEMBER SHACK: Right. Environmental-
19 enhanced fatigue.

20 MR. THORNTON: Right.

21 MEMBER SHACK: And presumably you would
22 have had to dealt with that in your license renewal.

23 MR. THORNTON: Okay.

24 CHAIR REMPE: Perhaps the staff can help
25 when they get up and talk about it, too. They

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1 reviewed it.

2 MR. BURFORD: Yes, our license renewal
3 review is going on right now with the staff.

4 MEMBER SHACK: Okay.

5 MR. BURFORD: That will be an aspect that
6 is covered in that application.

7 MR. THORNTON: Okay. With respect to
8 fracture toughness, the RPV embrittlement is caused by
9 the neutron exposure to the walls adjacent to the
10 core. We define a beltline region on the core with
11 greater than one times ten to the seventh neutrons.

12 And the fluence calculated for CLTP
13 conditions we know is conservative, more conservative
14 than that considered for EPU, which resulted in
15 minimal changes to these fluence values which were
16 reassessed for EPU.

17 The revised fluences were used to evaluate
18 the vessel against the requirements of the 10 CFR 50
19 Appendix G. And the results of the evaluations
20 indicate that the materials remain with good
21 properties. The upper shelf energy will remain
22 greater than 50 foot-pounds for the design life of the
23 vessel and maintain margin requirements.

24 Reference temperature, the nil ductility
25 transition for the beltline materials remains below

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1 200 degrees. And all the fluence for the beltline
2 materials is below two times ten to the eighteenth
3 neutrons per square centimeter.

4 Some other considerations for pressure
5 vessel internals and core support materials, there
6 were no material changes, as I noted, for these with
7 the exception of the replacement steam dryer.

8 The peak fluence that is experienced by
9 the reactor internals does not represent a significant
10 increase in the potential for the irradiation-assisted
11 stress corrosion cracking.

12 Grand Gulf does belong to the BWR Vessel
13 Internals Program organization and implements a
14 procedurally controlled program for the augmented
15 examination of selected components to ensure that we
16 maintain structural integrity with those components.
17 And the inspection techniques are to detect any flaws
18 or discontinuities within the welds or adjacent base
19 materials. And with respect to the internals, the
20 core internals, none have been identified.

21 There were three components that have been
22 identified as potentially susceptible to irradiation-
23 assisted stress corrosion cracking based on their end-
24 of-life fluences. These include the core top guide,
25 the core shroud, and the core plate. And all three of

1 these locations are managed under the vessel internals
2 program with inspection recommendations for those
3 which give the scope sample size, methods, and
4 frequency of examination.

5 MEMBER ARMIJO: For the inspections you
6 have done to date on those components, what is the
7 condition that we found, IASCC indications?

8 MR. THORNTON: No, there have not been any
9 indications found on the internals.

10 MEMBER ARMIJO: And these are, are they
11 the 316 nuclear-grade material or are they an earlier
12 version?

13 MR. THORNTON: Internals, I don't have the
14 exact details. I am not sure about the internals.

15 MEMBER SHACK: Well I'm pretty sure since
16 they did IHSI on the nozzles --

17 MR. THORNTON: Our vessel materials are a
18 533.

19 MEMBER SHACK: Yes, but that is a
20 permitted steel.

21 MEMBER ARMIJO: Yes, but that was a BWR-6.
22 So it was built later than the earlier BWRs, so you
23 should have had the benefit of the best materials when
24 had to make --

25 MR. THORNTON: Right. We will look that

1 up for you.

2 MEMBER ARMIJO: But the main point is they
3 have no IASCC indications and you have been protecting
4 them with hydrogen water chemistry.

5 MR. THORNTON: Correct.

6 MEMBER ARMIJO: I think that is all I
7 need.

8 MR. THORNTON: Okay, with respect to the
9 intergranular stress corrosion cracking for the
10 vessel, the temperature and flow increases do not
11 represent a significant increase in the potential for
12 that. The changes have negligible effect on the
13 tensile stresses and do not affect any of the other
14 susceptibility factors for that determination.

15 With respect to the piping, we do have an
16 in-service inspection program that is in accordance
17 with Section 11, coupled with an augmented program
18 that is based upon generic letters and BWR Vessel
19 Internals Program Guidance.

20 The inspection frequency requirements that
21 we apply are based upon normal water chemistry. So
22 the actual frequency of the inspections is greater
23 than would be required for a plant with hydrogen water
24 chemistry.

25 And for fluence on those vessel nozzles

1 and the safety in welds and piping, we found that they
2 all remain well below the five times to ten to the
3 twentieth neutrons per centimeter squared fluence
4 threshold for irradiation assistant concerns for
5 stainless steel components. There were no concerns
6 with that as well.

7 And just in concluding, we do have, as I
8 have noted, several mitigation processes that have
9 been applied at Grand Gulf to reduce susceptibility to
10 stress corrosion cracking. Grand Gulf was designed
11 and fabricated with IGSCC addressed in most welds by
12 one of three methods. We had corrosion-resistant
13 materials, solution heat treatments, and cladding with
14 resistant materials.

15 Any weldments where these three processes
16 were not used, we had stress improvement process
17 applied to reduce susceptibility. And as I noted, we
18 currently used the hydrogen water chemistry and online
19 noble metal to mitigate going forward.

20 So are there any other questions?

21 Okay, the things I noted then to follow up
22 is we will get some more information on our hydrogen
23 water chemistry monitoring. We will get the
24 information about core support materials and the
25 fatigue consideration in the environmental-enhanced

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1 consideration. Okay?

2 CHAIR REMPE: Thank you.

3 MR. THORNTON: Thank you.

4 CHAIR REMPE: Before we switch to the
5 staff, there was a person who had an answer to a
6 question that Steven Schultz raised.

7 MR. SMITH: Yes.

8 CHAIR REMPE: Do you want to come up and
9 do that?

10 MR. SMITH: Sure. Fred Smith again.

11 We looked at the last cycle that was
12 operated at non-EPU conditions.

13 MEMBER SCHULTZ: Yes, thank you.

14 MR. SMITH: And we compared that to our
15 first cycle at EPU conditions and the maximum
16 megawatts through the cycle for a bundle is virtually
17 unchanged. Numerically, it is 7.5 megawatts for the
18 non-EPU conditions and 7.6 megawatts for the EPU
19 conditions.

20 MEMBER SCHULTZ: For the bundle average
21 power?

22 MR. SMITH: No, the maximum.

23 MEMBER SCHULTZ: The maximum?

24 MR. SMITH: The maximum. Bundle average
25 would be just proportional to the power uprate.

1 MEMBER SCHULTZ: Okay, great. Thank you.

2 And I have one more question. You
3 mentioned that the 24-month cycle aspect of operation
4 in the next cycle. And so I presume this has been
5 planned. Did you over-enrich last cycle in terms of
6 preparing for the 24 months in the cycle coming up?

7 I looked at the fuel load for cycle 19 and
8 it didn't look that beefy, given 24-month cycles. So
9 I was just curious.

10 MR. SMITH: And it won't be quite a true
11 24-month cycle because of this long outage.

12 MEMBER SCHULTZ: Okay.

13 MR. SMITH: So in terms of actual calendar
14 days, I believe our next outage will be in February.
15 But we did do some over-enriching to smooth the
16 transition.

17 MEMBER SCHULTZ: So 20 to 21 months would
18 be the next cycle.

19 MR. SMITH: Yes, if we start up next week.
20 yes.

21 MEMBER SCHULTZ: That makes more sense.
22 Thank you.

23 MR. SMITH: Okay.

24 MEMBER SCHULTZ: I appreciate it.

25 MR. WIDREVITZ: Hello, everyone. I am Dan

1 Widrevitz from the Vessels and Internals Integrity
2 Branch. I will just go over the vessel and internals
3 material integrity.

4 So in terms of reactor vessel
5 embrittlement, the EPU itself increased the total
6 fluence on the reactor vessel, which is why we were
7 reviewing this.

8 For the reactor vessel at Grand Gulf, they
9 are members of the BWRVIP Integrated Surveillance
10 Plan. What that means is a lot of what we do with
11 regards to how well they are doing with material
12 properties is based on actual surveillance capsules.
13 And as a BWR, they are members of an integrated plan
14 with all the others -- with the majority of the rest
15 of the BWRs. As a consequence --

16 MEMBER SKILLMAN: Excuse me. Madame
17 Chairman, are we in a closed session or open session
18 right now?

19 CHAIR REMPE: We are going to be in open
20 session until the end of this presentation.

21 MEMBER SKILLMAN: Thank you. Excuse me.
22 I apologize. Thank you.

23 CHAIR REMPE: Okay.

24 MEMBER SKILLMAN: I was looking at the
25 Register and I am saying where are we.

1 CHAIR REMPE: We are about 15 minutes
2 ahead.

3 MEMBER SKILLMAN: Thank you.

4 CHAIR REMPE: No problem. Sorry about
5 that. Go ahead.

6 MR. WIDREVITZ: So for Grand Gulf, they
7 are not actually a host plant, which means they are
8 using data from surveillance capsules hosted in
9 similar other plants. They do actually have three
10 capsules in the reactor vessel, one of which was taken
11 out and put back in for one cycle gap but they are not
12 being used for anything at the moment.

13 As far as we are concerned, we are very
14 happy with that program. Also, Grand Gulf meets our
15 10 CFR Appendix G requirements for things like the
16 pressure temperature limits, their upper shelf energy
17 projections, their circumferential weld inspection
18 exemption was good, too. And for all of these
19 considerations, they have significant material margins
20 remaining even with on the EPU conditions.

21 A second big part of our review is the
22 internals and core support materials. Obviously, the
23 EPU increases total fluence on the internals as well
24 as the vessel. Of all of those internals, the top
25 guide, the shroud, and the core plate all exceed what

1 we consider to be the irradiation-assisted stress
2 corrosion cracking threshold for susceptibility.
3 These are managed, as members of BWRVIP, they are
4 managed under for the core plate BWRVIP-25, which has
5 all sorts of inspection evaluation guidance. The top
6 guide is managed under BWRVIP-183, and the shroud is
7 managed under BWRVIP-76. And that is all as it should
8 be. And we went through and we were happy with that.

9 Their water chemistry is managed under
10 BWRVIP-190 and we are happy with that. Hydrogen water
11 chemistry we are happy. The noble chem is also
12 implemented there. We noted that.

13 So in conclusion, the extended power
14 uprate is minimal impact on the reactor vessel
15 embrittlement issues. And three reactor vessel
16 internal components that exceeded the threshold for
17 irradiation-assistance stress corrosion cracking.
18 They exist and they are adequately managed under how
19 we have set things up with the BWRVIP folks.

20 So that is it.

21 CHAIR REMPE: Just out of curiosity on
22 slide 58, do you know what materials are used for
23 these core plates and like Dr. Armijo was asking
24 earlier, do you know what the material is?

25 MR. WIDREVITZ: Not offhand.

1 CHAIR REMPE: Okay, we will just wait for
2 the licensee's presentation.

3 MEMBER ARMIJO: I think it is 316 nuclear
4 grade --

5 MR. WIDREVITZ: I would suspect that it is
6 316 --

7 MEMBER ARMIJO: -- but I don't remember.

8 MR. WIDREVITZ: -- but I don't want to say
9 it without being sure.

10 MEMBER ARMIJO: But somebody should know.

11 (Laughter.)

12 MR. THORNTON: This is Thomas Thornton.
13 I did get some information on the shroud and the core
14 plate and such are 304L material. And the shroud
15 supports are an Alloy 600 material.

16 MEMBER ARMIJO: Okay. And the top guide,
17 did you get that?

18 MR. THORNTON: Not yet.

19 MEMBER ARMIJO: Okay.

20 CHAIR REMPE: I'm saying okay but the 304L
21 -- What was the shroud? I got distracted. What was
22 the last material? All three are 304L?

23 MR. THORNTON: The shroud and the core
24 plate I have confirmed are both 304L materials.

25 And the shroud support is an Alloy 600.

1 CHAIR REMPE: Okay. If there are no more
2 questions on this topic, we are supposed to, if we
3 would follow the agenda, we would go to a closed
4 session at 2:15 but we are a bit ahead and we have a
5 break coming. So why don't we have a break and
6 reconvene at 2:00? And at that time we will go to
7 closed session and the room will be clear except for
8 those who are supposed to be here. Does that sound
9 good?

10 (Whereupon, the foregoing matter went off
11 the record at 1:42 p.m. for a closed
12 session and went back on the record at
13 4:41 p.m., continuing the open session.)
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(4:41 p.m.)

CHAIR REMPE: Closed session is now over.

MR. JESSUP: My name is Billy Jessup in Division Engineering at NRR. And there was a question that came up earlier about the environmentally assisted fatigue. And the 40-year usage factors that the licensee presented in their mechanical impacts presentation, those do not account for environmental fatigue. That is a phenomena that is captured for a period of extended operation. That comes up in licensing.

MEMBER SHACK: Yes, after I asked the question, I sort of realized that was the answer.

CHAIR REMPE: Okay, before we go to your response to questions, there was a possible presentation about tech spec changes.

MR. WANG: I originally had planned to say something but all of the tech spec changes were actually discussed during the meeting.

But basically to support the EPU, the staff reviewed and issued three tech spec changes. The standby liquid control, the MCPR and the Power Range Neutron Monitoring System. All three of those tech specs were required for startup for the EPU and

1 those have been reviewed and approved.

2 The Power Range Neutron Monitoring System
3 was actually a license condition originally because
4 were weren't sure we were going to be able to finish
5 it before the outage restarted. So that was
6 completed. So that license condition actually can be
7 removed from the -- will be removed from the safety
8 evaluation.

9 And then the other two were also, we were
10 able to complete because they needed those for startup
11 from the outage, even if they did not get the EPU
12 because of the change in the fuel.

13 The only other tech spec change really was
14 they have agreed to, it was thought up on the
15 containment pressure. They had been using the long-
16 term P sub a, the 11.5 or so. When they redid their
17 analysis and it was 14.8, they were still proposing
18 the use the long-term lower limit. They had justified
19 that based on the limited area where the pressure was,
20 the length of the time of pressure, and also that
21 because the accident doses would not have been
22 affected because it was early in the accident.

23 So however, the staff didn't agree. The
24 staff's position was that the regulation Appendix J
25 doesn't give that ability to decide. It just says you

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1 usually calculate at maximum peak and the licensee
2 agreed. And they will be using the 14.8 for P sub a,
3 or have used the 14.8 in their current outage to
4 calculate the leakages for the Appendix J testing.

5 MEMBER SCHULTZ: And that goes into the
6 technical specifications.

7 MR. WOOD: That has gone into the
8 technical specifications, yes.

9 MEMBER SCHULTZ: So just to repeat back
10 what I understood you to say is that based upon
11 actions already taken, there won't be license
12 conditions imposed. There will be tech spec changes
13 but not license conditions.

14 MR. WANG: Not on those issues but there
15 is a license condition on the steam dryer, --

16 MEMBER SCHULTZ: Okay.

17 MR. WANG: -- a license condition on the
18 spent fuel pool. And there is one license condition
19 on -- they have requested not to change their Appendix
20 J testing schedule because of the EPU. And we have
21 agreed to that also.

22 MEMBER SHACK: Now in the SE, the license
23 condition on the steam dryer is sort of based on
24 language proposed by the applicant. Has that been
25 accepted by the staff?

1 MR. WANG: That was negotiated, yes.

2 MEMBER SHACK: Oh, okay. So that language
3 I see in the SE is the language.

4 MR. WANG: Yes, it is.

5 CHAIR REMPE: Are there any questions?
6 Okay, and then should we let the licensee come back
7 and answer some of the questions we raised earlier
8 before we do the public comment and the discussion?

9 MR. VERROCHI: The document that you
10 referenced you were interested in on the surface
11 roughness, it is a BWRVIP document. So it is a
12 proprietary document as an EPRI document. So I can
13 speak to it and the document is certainly available to
14 the NRC. It is BWRVIP-181A.

15 And what it references, and I will read
16 the specific data that it references, for replacement
17 steam dryers in addition to the requirements of
18 BWRVIP-84, surface roughness and unfavorable surface
19 residual stresses are to be minimized by application
20 of the following procedures.

21 The edges of all wells shall be blended
22 into the adjacent base material by flapping or
23 polishing with a series of finer grits alternating
24 direction with finer grit and finishing with 120-grit
25 polishing.

1 All heat-affected zones in areas that have
2 been ground shall be finished by flapping and
3 polishing in this manner so that the surface roughness
4 is 63 RMS or smoother. So that is -- This document is
5 the methods to be used to prevent IGSCC. So that is
6 the purpose of this document and that is the process
7 that was used for this.

8 MEMBER ARMIJO: And that is all very good
9 but I asked if there was any test data that
10 demonstrated the benefits of that compared to the
11 normal heavy post-weld grinding. And that was the key
12 question.

13 MR. VERROCHI: Okay.

14 MEMBER ARMIJO: And if they had a report
15 on that, I would like to see it.

16 MR. VERROCHI: Yes, we can answer that.

17 MR. JAMES: This is Mike James again. I
18 asked the question a little bit differently of our
19 materials expert asking more precisely about the
20 effect of cold working on IGSCC, whether we had any
21 test data in doing that, not specifically to the 63
22 finish requirement in BWRVIP-181.

23 We do have some published data which we
24 can provide to you that shows curves and some other
25 information. I have not yet received that this

1 evening. I expect to see it in the next half an hour
2 or so.

3 MEMBER ARMIJO: Okay. Well, let me make
4 sure that you understand why I am asking this. I used
5 be involved in IGSCC research in the pipe-test lab in
6 the industry. And one of the ways we could always get
7 something to crack is post-weld grinding.

8 And I have been finding a campaign all my
9 career trying and get people to quit doing that. And
10 clearly that is the EPRI procedure is very good but I
11 was hoping that there was some test data that made it
12 very clear how harmful that process, what I call
13 abusive grinding as compared to this more
14 sophisticated technique.

15 And so I am looking for data that
16 demonstrates that this improved technique actually is
17 better than the old dangerous technique. That is what
18 I am looking for.

19 MR. VERROCHI: Right. I can't speak to
20 what the -- You know, based on what EPRI typically
21 does, we would expect to have a lot of testing to back
22 this up.

23 I'm sure that is accounted for in that
24 document and is probably referenced in that document
25 but we can also provide you the published documents

1 that GE has, too.

2 So I think this document would provide
3 some of the information you want. I just don't have
4 it today.

5 MEMBER ARMIJO: Okay.

6 CHAIR REMPE: Is there anything else you
7 wanted to respond to?

8 MR. VERROCHI: Thomas?

9 MR. THORNTON: I am Thomas Thornton. I
10 had a couple of items to follow up. One was with
11 respect to the hydrogen water chemistry and how we
12 control that.

13 We inject hydrogen at a fixed rate,
14 control the flow of that. It is set up on a system to
15 put in a desired amount of hydrogen concentration
16 based upon feedwater flow rate. So it does have a
17 control system that automatically controls the rate
18 based upon feed flow to maintain that rate constant.

19 With the noble metal chemistry system, we
20 did install a mitigation monitoring system that does
21 allow us the ability to monitor the electrochemical
22 potential so that we can get an indication and have
23 seen good indications when we have done the noble
24 metal injections that tell us that we have good
25 protection in place with our target electrochemical

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1 potential of less than a negative 400 millivolts.

2 So, we are maintaining our hydrogen
3 concentration at the levels that we have determined to
4 be effective.

5 MR. SMITH: This is Fred Smith. Let me
6 add just a point to that.

7 The way that hydrogen level is determined,
8 the EPRI VIP has a software module called BWR VIA.
9 That model would be modified to account for uprated
10 power conditions. And then that model would be run to
11 estimate the hydrogen required to achieve a molar
12 ratio of three to one in the upper area of the plenum.

13 Then, as Thomas said, we will do a runback
14 on the hydrogen during initial plant startup and
15 evaluate the ECP change and validate if the predicted
16 hydrogen levels are achieving the desired ECP.

17 MEMBER SHACK: Where is that ECP measured?

18 MR. SMITH: I think it is measured -- I
19 believe we are using an LPRM detector but I can't say
20 it is extrapolated to the point.

21 MEMBER SHACK: I'm impressed. I thought
22 it was the recirc line or someplace that really --

23 MR. SMITH: I should probably be careful.
24 I believe that is what we were trying to do.

25 But the measurement is extrapolated to the

1 point in the lower internals.

2 MEMBER ARMIJO: How long do your probes
3 last? How long do your ECP probes last?

4 MR. THORNTON: We haven't maintained the
5 system operating. We have seen problems with that
6 when we have done it. We have been able to get
7 measurements a couple of times when we have done our
8 noble metal injection and validate our ECP at that
9 time.

10 MR. SMITH: Yes, if the ECP probe fails,
11 we will use secondary indications of reactor water
12 oxygen.

13 MEMBER ARMIJO: So it is Bill's question,
14 your oxygen to hydrogen ratio.

15 MR. THORNTON: Right.

16 MEMBER ARMIJO: Okay.

17 CHAIR REMPE: Okay.

18 MR. THORNTON: Okay, the other issue was
19 with respect to reactor internal materials. I just
20 want to come back with I did confirm that both the
21 shroud, the core plate, the top guide, and all the
22 internal structures that are welded to those or Type
23 304L materials. As I said, the shroud support is an
24 Alloy 600 material.

25 And then the other support material, some

1 peripheral fuel supports, studs, nuts, CRD housing and
2 guide tubes are all Type 304 materials.

3 CHAIR REMPE: At this point, I think it is
4 time to ask if there is anyone on the phone line and
5 if they have any comments they would like to make as
6 members of the public. Are they in a mode where they
7 can actually speak up? Is there anyone out there that
8 can verify that they can communicate with us?

9 MR. BROWN: There is no one on the phone
10 lines.

11 CHAIR REMPE: Oh, okay. So the public is
12 no longer interested I guess.

13 So I guess we will ask the committee
14 members if they have -- The members in attendance, do
15 they have any comments? Well, I guess we will start
16 with the consultants.

17 Do you want to start off, Graham with any
18 comments?

19 CONSULTANT WALLIS: Well, I was a bit
20 puzzled to read in the report that this session was
21 only for information. Is that right or are you going
22 to write a letter?

23 CHAIR REMPE: No, we are going to write a
24 -- We are going to have a shorter meeting, two hours,
25 a the full committee meeting and then we will write a

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1 letter.

2 CONSULTANT WALLIS: So you are going to
3 write one. I thought you would.

4 CHAIR REMPE: Yes.

5 CONSULTANT WALLIS: Well I think this went
6 very well. I mean all the questions seemed to be
7 answered competently.

8 The steam dryer was the issue of interest,
9 I think, really. And that has come a long, long way
10 since we started this matter. And I think we have a
11 lot more confidence in the answers. There is still a
12 question of surprises when you actually take data. So
13 I am glad they are carefully incrementing the power
14 and looking at the data.

15 But I'm not sure you even need a report
16 from me because I don't think there are even any
17 questions. Things went pretty well.

18 CHAIR REMPE: Okay, well maybe a short
19 report saying you are happy would be good. And all
20 the other people who have had committee meetings with
21 you as a consultant will be jealous.

22 (Laughter.)

23 CHAIR REMPE: Mario, do you have any
24 comments?

25 CONSULTANT BONACA: I echo what Graham

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1 said. Even before coming to this meeting, after
2 reviewing the application I thought it was a quality
3 application, a quality SER. And most of all, it seems
4 to me that it is going to pervasive it with
5 conservative decisions and both technically but also
6 some of the decisions on the dryers re-qualifying the
7 containment at the higher temperature. There was a
8 number of things which are not essential but they give
9 you a sense of comfort with what you have.

10 So I write a report and that will point
11 out some of those issues.

12 CHAIR REMPE: Thank you. Let's go around
13 with the members. Do you want to start, Jack? Do you
14 have any comments?

15 MEMBER SIEBER: Well actually, I think
16 that this all went pretty well. And I think we have
17 come a long way since the days of Quad Cities.

18 And I don't have any major outstanding
19 issues at this time.

20 CHAIR REMPE: Okay, thank you. Dick, do
21 you have any comments?

22 MEMBER SKILLMAN: Yes, I appreciate the
23 evidence of conservatism that has been communicated
24 through the entire presentation. I also appreciate
25 the thoroughness of the information that is in the SER

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1 by the staff and that has been presented by the
2 Entergy team.

3 I note that the Entergy team said we think
4 that those instruments will last about six weeks and
5 probably more but the power ascension testing is six
6 to eight weeks. So I encourage two more weeks upon
7 your instruments.

8 I appreciate the update on tritium in the
9 groundwater. It appears as though that was underway
10 well before industry was moving on this. And with 19
11 more wells being drilled, that tells me that Entergy
12 is serious about being able to describe what is
13 occurring in the aquifer underneath the plant. That
14 is important.

15 Overall, thank you. A very good
16 presentation. Thank you.

17 CHAIR REMPE: Stephen?

18 MEMBER SCHULTZ: I would just echo the
19 comments related to the thoroughness and the
20 completeness of the presentations both by the licensee
21 and the staff in the discussions that were planned for
22 today. And also thank you for the extra effort that
23 you put in today to get answers to our questions.
24 That helps a lot to close out the open items that we
25 had during the day and will be very helpful as we move

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1 forward in the deliberations.

2 So I thank both the staff and the
3 applicant for that.

4 CHAIR REMPE: Thanks. Sam?

5 MEMBER ARMIJO: Everything was in very
6 good shape, very well prepared, very thorough. An
7 awful lot of effort has gone into the dryer but I
8 think a lot of effort has gone into other parts of the
9 plants, including the core, the fuel, the water
10 chemistry which I am very interested in. Just
11 basically a very good application. Good work by the
12 staff as well in reviewing it.

13 So I am onboard.

14 CHAIR REMPE: Bill?

15 MEMBER SHACK: I would just echo
16 everything everybody else said. I mean, I think it
17 was very well done. Both the SE and the documentation
18 supplied by the applicant I thought were really first
19 rate. The steam dryer was almost enjoyable to read.

20 MEMBER SIEBER: It's all relative.

21 (Laughter.)

22 CHAIR REMPE: Well again, I appreciate
23 everybody's efforts and their presentations. I know
24 it has been a long haul. I appreciate everyone
25 working hard to get it done.

1 There were two outstanding items that I
2 know of. One is this document that you have
3 requested, Sam.

4 MEMBER ARMIJO: Yes.

5 CHAIR REMPE: And the other one is kind of
6 a two-part one. One is with GE. We have asked to see
7 the data for thermal conductivity that was used to
8 validate or to develop the PRIME model as a function
9 of burnup and temperature. And it has become a hotter
10 issue with the committee. And you will have the other
11 folks at the full committee meeting and I think it
12 would behoove you to get that to us ahead of time, if
13 you could.

14 And if the staff could explicitly let us
15 know did you do an independent audit, calculations
16 with FRAPCON would be helpful to know that.

17 MS. LUND: I actually tried to call them.
18 I called and I got the voice mail. So I sent him an
19 email. So let's see if I get something.

20 CHAIR REMPE: It doesn't have to be in the
21 next 24 hours but it will be good well before the June
22 4th meeting.

23 MEMBER SIEBER: I also asked for the
24 thermal conductivity degradation documents --

25 CHAIR REMPE: From GE. Yes. I'm sorry.

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1 You are right. So there are three aspects associated
2 with that that we definitely would like to have. And
3 actually Stephen Schultz mentioned he would like it,
4 too.

5 MEMBER SIEBER: What the data is and where
6 the data came from.

7 CHAIR REMPE: Right. And I'm afraid it
8 might not be in the documents explicitly and that is
9 why I am asking for that plot, too.

10 Okay. And so then with that, we have a
11 two-hour time frame when we have the full committee
12 meeting allocated. And presentations will have to be
13 carefully performed to make sure we can -- half the
14 time should be planned for presentations because there
15 will be questions.

16 And with that, are there any other items
17 that I may have forgotten? Everybody is ready to call
18 it quits. So I will adjourn the meeting.

19 (Whereupon, at 5:01 p.m., the foregoing
20 matter was adjourned.)

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ACRS Subcommittee on Power Upgrades

Evaluation of Extended Power Upgrade Grand Gulf Nuclear Station



May 24, 2012



U.S.NRC

UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment

GGNS EPU Opening Remarks

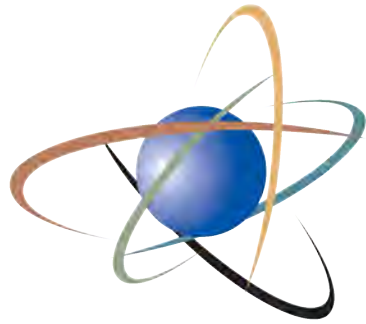
Louise Lund

Deputy Director Regions I and IV
Division of Operating Reactor Licensing
May 24, 2012

GGNS EPU Review Methodology

- The licensee requested the EPU following the guidance of NRC Office of Nuclear Reactor Regulations Review Standard (RS)-001, Revision 0, “Review Standard for Extended Power Upgrades.”
- The licensee implemented the methodology that was approved by the staff in licensing topical report NEDC-33004P-A, “Constant Pressure Power Uprate.” (CLTR)
- In general the licensee followed the guidance in the CLTR. However, because GGNS uses GNF2 fuel, NEDC-33004 was not applicable for the fuel-design-dependent evaluations and transient analyses. For fuel dependent topics and transient analyses, the licensee followed the review guidance in NEDC-32424, “Generic Guidelines for GE BWR EPU,” (ELTR1) and NEDC-32523 (ELTR2). We did not identify any major deviations in the application for the implementation of the CLTR, ELTR1 and ELTR2 topical reports.

The EPU review was extended because GGNS is the first application to an operating plant of GEH's Plant Based Load Evaluation (PBLE) methodology for the steam dryer review. Neither the licensee or the staff referenced prior efforts related to the PBLE as related to the ESBWR review.



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Meeting Purpose

Review of Grand Gulf Nuclear Station
Extended Power Uprate

Alan Wang, Project Manager

Agenda

- Presentations will be made by Entergy and the NRC staff
- Major Considerations of the review which will be discussed include:

Transient and Accident analyses

Long-term stability

Spent Fuel Pool Criticality

Power Range Neutron Monitoring System

Mechanical Impacts

Steam Dryer Review (Closed)

License Conditions

- Steam Dryer and the Spent Fuel Pool reviews resulted in two additional license conditions
- The spent fuel pool review resulted in a separate nuclear criticality safety review amendment. In the interim the licensee has proposed a license condition for the spent fuel pool loading until this amendment can be completed
- The steam dryer review resulted in a license condition requiring the submission of a power ascension test program and specific conditions for ascension to extended power uprate conditions

- The review, in general, did not deviate from the guidance in the RIS, the CLTR, and the ELTRs 1 and 2

Fuel and Reactor Systems Evaluated By Reactor Systems Branch (SRXB)

Safety Evaluation Section 2.8

Reviewers:

M. Razzaque	T. Huang	T. Nakanishi
J. Miller	L. Ward	P. Clifford

Review Scope

- Staff reviewed the impact of EPU on Grand Gulf Nuclear Station (GGNS):
 - ☐ Fuel system and nuclear design
 - ☐ Thermal-hydraulic design
 - ☐ Overpressure protection
 - ☐ SLC system
 - ☐ Transient analysis (AOOs)
 - ☐ LOCA
 - ☐ ATWS
 - ☐ GE methods

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 - ☐ LOCA
 - ☐ ATWS
 - ☐ GE methods

Review Method

- Scope of EPU evaluations generally followed NRC-accepted, generic EPU guidelines and evaluations (ELTR-1, ELTR-2, and CPPU)
- Analyses and evaluations are based on NRC-approved methodologies, analytical methods, and codes
- Followed the EPU review standard (RS-001)

Fuel System and Nuclear Design

- Next cycle (Cycle 19) is 1st EPU core comprised of mostly GNF2 fuel and some GE14 legacy fuel
- EPU transient and accident analyses used GNF2 equilibrium core
- Reload analyses uses exact core design – Results documented in SRLR and verified by the NRC staff
- Peak bundle power expected to increase by ~ 5.4% after EPU (within experience base)
- Thermal limits (SLMCPR, OLMCPR, MAPLHGR, and LHGR) are determined during reload analysis, including any mid-cycle revisions [GGNS T/S 5.6.5.d] – Included in COLR [GGNS T/S 5.6.5]
- Hot excess reactivity and shutdown margin are determined in the reload analysis consistent with GESTAR-II

Overpressure Protection

- Staff approved ODYN code used for overpressure analysis at 102% EPU power
- Limiting event: MSIVF (7 SRVs Out-of-Service)
- Peak pressure: 1,334 psig (< ASME limit of 1,375 psig)
- No SRV setpoint change required & no effect on SRV functionality: opening/closing
- Most limiting pressurization event will be analyzed for each reload

Standby Liquid Control System

- Manually operated system
- 86 gpm boron equivalency is satisfied for EPU
- Sufficient margin exist for the pump discharge relief valves to remain closed during system injection
- Shutdown boron concentration (660 ppm) does not change for EPU
- SLCS shutdown capability reconfirmed for every reload

Anticipated Operational Occurrences (Transient Analysis)

- Limiting transients analyzed per ELTR-1 Appendix E:
 - ☐ Thermal limit events to establish OLMCPR
(Most limiting event is LRNBP)
 - ☐ Overpressure events to establish peak pressure
(Most limiting event is MSIVF)
 - ☐ Loss of water level events to establish minimum level
(Most limiting event is LOFW)
- Cycle-specific reload transient analysis will be performed using staff-approved methods

ECSS Performance (LOCA)

- Staff-approved SAFER/GESTR codes used
- Licensing Basis App. K PCT is $\leq 1,690^{\circ}\text{F}$ for limiting LBLOCA at EPU ($< 2200^{\circ}\text{F}$)
- Limiting LBLOCA is Recirculation Suction Line Break with HPCS-Diesel Generator failure (limiting single failure)
- Reload analysis confirms MAPLHGR to validate PCT
- Comply with 10 CFR 50.46 and Appendix K requirements

Anticipated Transient Without Scram (ATWS)

- ATWS Mitigation Requirements (10 CFR50.62) Satisfied:
 - ☐ Alternate rod insertion (ARI) system installed
 - ☐ Boron injection capability equivalent to 86 gpm of 13 Wt% natural boron-10 into 251 in RPV
 - ☐ ATWS-recirculation pump trip logic installed
- Operator Action:
 - ☐ EOP follows BWROG EPG/SAG, Rev. 2
 - ☐ EPU not a significant burden to operators during ATWS
 - ☐ Confirmed by the staff audit
- Results for limiting event analysis using staff approved ODYN code:
 - ☐ Peak pressure 1,455 psig (< 1500 psig ASME limit)
 - ☐ PCT 1,560°F (< 2200°F 10 CFR 50.46 limit)
 - ☐ Peak suppression pool temperature 165°F (< 210°F Design limit)¹⁸

Conclusions

- GGNS PUSAR is consistent with NRC-accepted guidelines and generic evaluations for EPU
- Thermal limits and the applicable safety analyses will be reanalyzed or reconfirmed using NRC-approved core reload analyses methodology

Fuel Methods Evaluation for Grand Gulf EPU

Review Objective and Scope

Objective

- Assess applicability of approved GE Fuel Methods to GGNS EPU conditions

Scope

- Limited to topics included in Interim Methods Licensing Topical Report (IMLTR):
 - ❑ NEDC-33173P “Applicability of GE Methods to Expanded Operating Domains”
- Applicability of GE Methods to GNF2 fuel

IMLTR (NEDC-33173P) Overview

- IMLTR (NEDC-33173P) describes applicability of GE neutronic and T-H methods for BWR EPU and M+ applications
- Staff approved IMLTR (NEDC-33173P) with limitations and conditions
- ACRS concurred with staff conclusions
- GGNS referenced IMLTR (NEDC-33173P) for EPU application

Review Approach

- Ensure compliance to plant specific application process specified in the staff SE for IMLTR (NEDC-33173P):
 - ❑ IMLTR Limitations and conditions
 - ❑ Key core parameters within experience base
- Additional assessment of GNF2 fuel

NEDC-33173P Compliance

Staff verified that:

- GGNS complies with all applicable limitations and conditions specified in the SER for IMLTR (NEDC-33173P)
- GGNS key core parameters are within operating experience base

Applicability of GE Methods to GNF2 Fuel

- On Dec. 28, 2010, staff SER was issued for NEDC-33173P (Supplement 3), “Applicability of GE Methods to Expanded Operating Domains – Supplement for GNF2 Fuel”
- SER concluded that all guidance, limitations, conditions and conclusions documented in the SER for the IMLTR (NEDC-33173P) remain applicable for GNF2 fuel

Applicability of GE Methods to GNF2 Fuel (Contd.)

Thermal-Conductivity Degradation(TCD):

- To address TCD issue, staff SER Condition 12 requires PRIME (T-M code) for EPU
- PRIME was calibrated and validated against extensive database
 - Effects of TCD explicitly modeled in PRIME
 - Staff approved PRIME on January 22, 2010
- Therefore, TCD is acceptably addressed for GGNS EPU

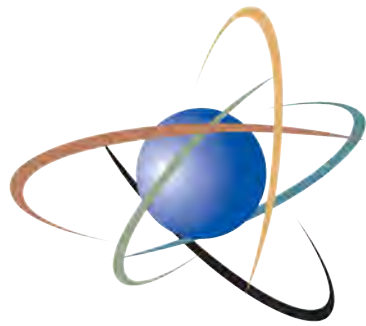
Review Conclusions

IMLTR (NEDC-33173P) is appropriate for GGNS EPU

- GGNS complies with all applicable IMLTR limitations and conditions
- GE Methods is applicable to GNF2 fuel
- GGNS EPU will operate within the current experience base

Acronyms and Abbreviations

AOO –	Anticipated Operational Occurrence
HPCS –	High Pressure Core Spray
LBLOCA –	Large Break Loss Of Coolant Accident
LOCA –	Loss Of Coolant Accident
LOFW –	Loss Of Feedwater
LRNBP –	Generator Load Rejection with Steam Bypass Failure
MAPLHGR –	Maximum Average Planar Linear Heat Generation Rate
MSIVF –	Main Steam Isolation Valve closure with Flux scram
OLMCPR –	Operating Limit Minimum Critical Power Ratio
PCT –	Peak Clad Temperature
SLCS –	Standby Liquid Control System
SLMCPR –	Safety Limit Minimum Critical Power Ratio
SRV –	Safety Relief Valve



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Grand Gulf EPU ATWS & Stability

Dr. Tai L. Huang (NRR/ADES/DSS/SRXB)

Dr. Jose March-Leuba (ORNL)

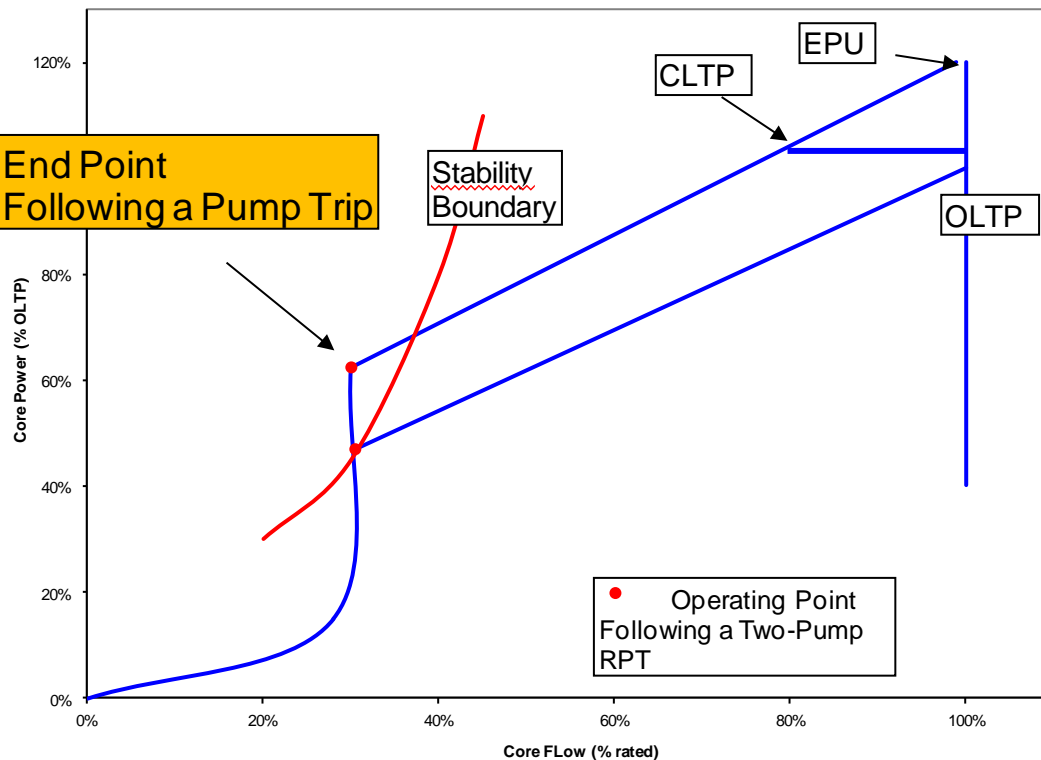
ACRS Subcommittee Meeting

May 24, 2012

Staff SER

- Staff has completed a SER with positive findings based on the review of available documents and a staff audit
 - Current LTS (Sol E1A) is being replaced by DSS-CD
 - CDA not armed (only required for MELLLA+)
 - PBDA (OPRM scram) provides the licensing basis
 - Staff audit (10/27/2011) concluded that
 - GG operators show good understanding of stability and ATWS issues for EPU.
 - Staff observations of operators' action in the simulator support the customary 120 s delay assumed for safety calculations
 - GG EOPs are adequate for EPU

EPU Does Not Change the End Point After The Recirculation Pump Trip



- End Point is the same for CLTP and EPU because it is defined by
 - Natural Circulation
 - Subcooling
- Stability characteristics of end point are similar

Stability

- LTS Option E1A installed in 98, and armed since 2000
- As part of the EPU upgrade, GG is installing a NUMAC digital power range monitor (PRM), which includes Solution DSS-CD
 - GG will not arm the confirmation density (CDA) algorithm
 - PBDA (Solution III) will be the licensing basis
 - GEH is expected to perform the Solution III setpoint analyses using standard approved procedures
- No impact expected from EPU
 - Option III and DIVOM methodology are applicable

ATWS-Instability

- GG has implemented latest EPG/SAGs
 - Automatic recirculation flow runback
 - Manual water level reduction
 - Manual boron injection
- Main source of high pressure injection is feedwater
 - 100% steam driven
 - Not available after isolation (few minutes buffer)
 - Available after turbine trip (high pressure steam)
- GG requires partial depressurization (~500 psi) to use the motor-driven condensate storage pumps because 100% of the FW feed is steam driven

Staff Audit

- Staff reviewed EOPs and TS
- Staff reviewed DSS-CD implementation plans
- Staff reviewed ATWS performance in the simulator (2 different scenarios from 2 different initial conditions)
 - Turbine Trip ATWS at BOC and MOC
 - MSIV Isolation ATWS at BOC and MOC
- GG submitted additional information with the simulator ATWS results from EPU conditions after EPU modifications were implemented in the simulator. The staff has updated the audit report with these runs.

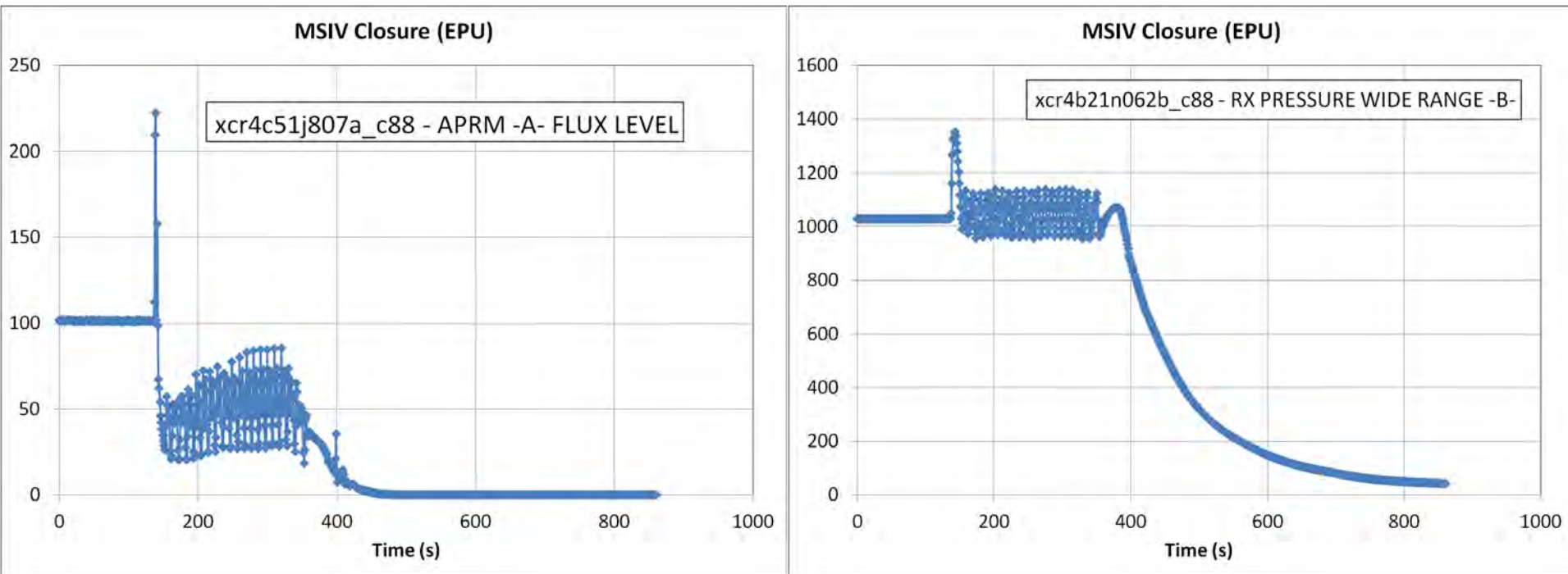
BWR 6 ATWS Performance

- Grand Gulf has BWR-6 specific ATWS characteristics
 - Only high pressure injection (with volume) is FW, which is 100% steam driven
 - Cold water injection not available with MSIV closed
 - Level reduction is automatic because of FW trip
 - ATWS procedures call for partial depressurization (~500 psi) to use the motor-driven condensate storage pump
 - However, steam pressure is available for 2-3 minutes following MSIV closure
 - Boron injection is through the core spray – fast response
 - Mark III containment has large heat capacity

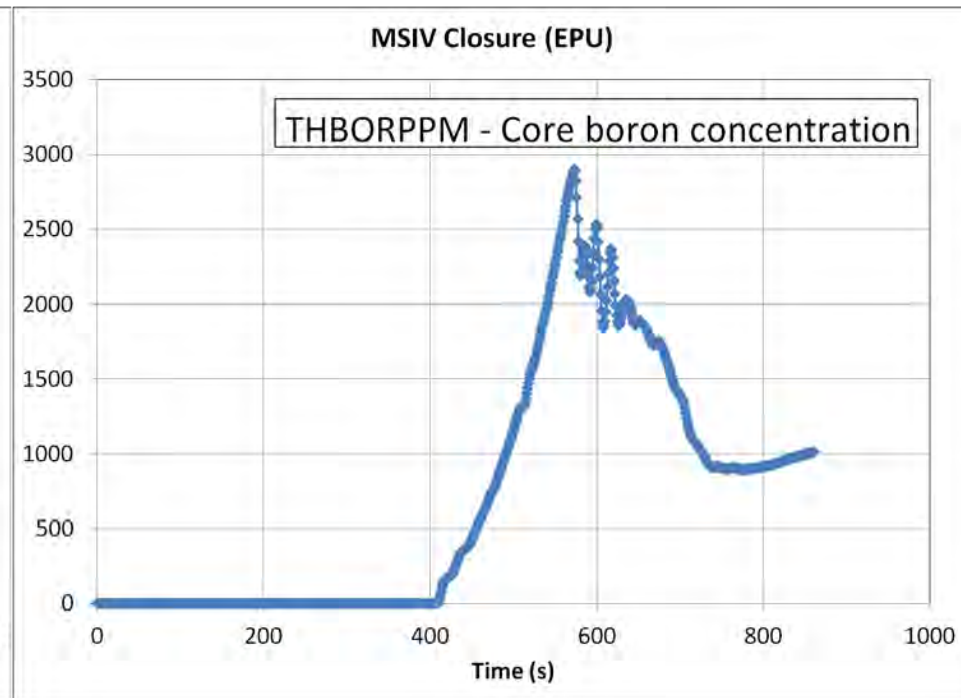
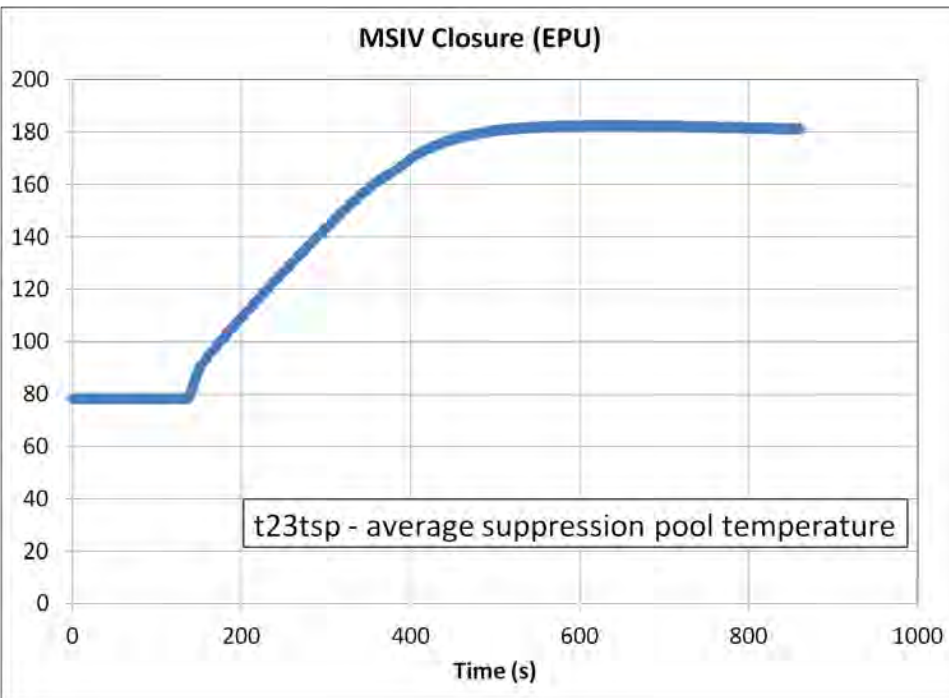
Simulator Scenarios

- A number of scenarios were executed. This is a representative sequence for MSIV closure
 - 0:00 MSIV isolation. Automated recirculation pump trip
 - 0:11 Recognize event and enter EP2A (ATWS) procedure
 - 1:30 Inhibit ADS
 - 1:40 Override HPCS
 - 2:10 Order to terminate FW.
 - » Establish level control between -70" to -161"
 - 3:30 Initiate pressure reduction to ~500 psi
 - 4:40 Order to initiate SLC
 - 7:00 Order to control pressure between 350 and 500 psi
 - 11:50 Order to initiate hydrogen igniters
 - 12:50 Order to maximize suppression pool cooling

Simulator shows acceptable ATWS response. Partial depressurization is required.

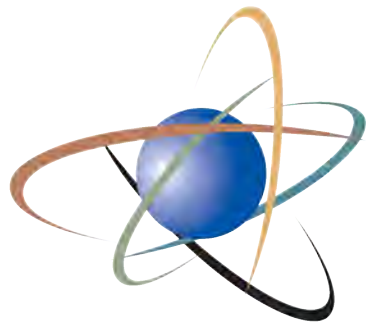


Simulator shows margin to suppression pool limits



Summary

- EPU operation is acceptable from stability point of view
 - When installed the LTS (Sol III) provides similar level of protection under EPU and OLTP
 - OPRM scram satisfies GDC 10 and 12
- ATWS and ATWS-Stability not affected significantly by EPU
 - Satisfies ATWS Acceptance Criteria (10CFR 50.62)
 - Grand Gulf requires partial depressurization to use the condensate storage pumps
 - HCTL is not compromised during transient
- GG operators can manage an ATWS event successfully, and implement the EOPs within the assumed timing



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GGNS EPU Spent Fuel Pool Nuclear Criticality Safety Analysis

Kent A. L. Wood

Division of Safety Systems

Reactor Systems Branch

May 24, 2012

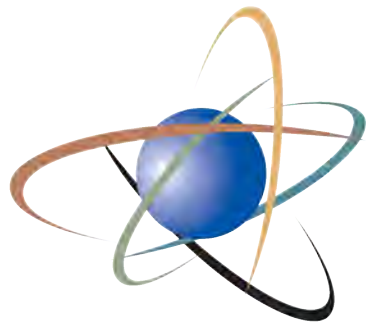
Extended Power Uprate

- Post EPU Conclusion on GDC 62
 - NEDC-33004P-A: nothing on GDC 62
- SFP NCS AOR relies on Boraflex
- Boraflex Degradation
 - Divided SFP into two regions
 - Not submitted
- SFP License Condition

SFP License Condition

- Region 1: Boraflex Credit
 - 0.0179 g/cm² B-10 Areal Density
 - 2.3 E10 Gamma Dose
 - SCCG $k_{inf} \leq 1.26$
- Region 2: No Boraflex Credit
 - 10 of 16 storage configuration
 - SCCG $k_{inf} \leq 1.21$
- Limited to EOC 19

Questions



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GGNS EPU STATION BLACKOUT

Swagata Som
Electrical Engineering Branch
Division of Engineering

EPU impact on plant's ability to withstand SBO.

- GGNS is a four-hour coping plant.
- Major characteristics that affect the ability to cope with an SBO:
 - Condensate Inventory for Decay Heat Removal
136,014 gallons needed - 143,000 gallons available.
 - Class 1E Battery Capacity
No extra load added to the Division 1 or 2 125 V DC system.
 - Compressed Air Capacity
Air operated valves have sufficient compressed air for operation during the SBO event.
 - Effects of Loss of Ventilation
Areas evaluated for temperature increase: Control Room and Upper Cable Spreading Room, Reactor Core Isolation Cooling Pump Room, Steam Tunnel, Switchgear Room/Inverter Room, Drywell.
 - Containment Isolation
Not adversely affected by the SBO event for EPU.
- The EPU will not adversely impact GGNS capability to mitigate the consequences of an SBO event.

Grand Gulf Nuclear Station (GGNS) Instrumentation & Control (I&C) Modification for Power Range Neutron Monitor (PRNM) Retrofit

for
Grand Gulf, Unit 1
Issuance of License Amendment 188
(Proprietary - [ML120320352](#),
Non-Proprietary - [ML120400319](#))

NRR/DE/EICB - Bernard F. Dittman

Overview of GGNS PRNM Retrofit

- Supports the Extended Power Uprate (EPU) by providing the Oscillation Power Range Monitor (OPRM) Option III Detect-and-Suppress Stability Trip function
 - General Electric (GE) Licensing Topical Report (LTR), NEDC-321410P-A
- Applies General Electric-Hitachi (GEH) Nuclear Measurement Analysis and Control (NUMAC) digital components to replace analog components
 - Similar to other licensee's prior PRNM retrofits
- Includes safety and non-safety equipment for installation in the control room

Overview I&C Safety Evaluation

- Used applicable regulatory guidance for digital I&C reviews:
 - Per NUREG-0800, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition” Chapter 7, “Instrumentation and Controls”
 - Regulatory Guides
 - Branch Technical Positions (BTPs)
 - Digital I&C Interim Staff Guidance (DI&C-ISG)
- Applied guidance that had been created or revised since the LTR’s review and approval

GGNS PRNM Equipment Configuration

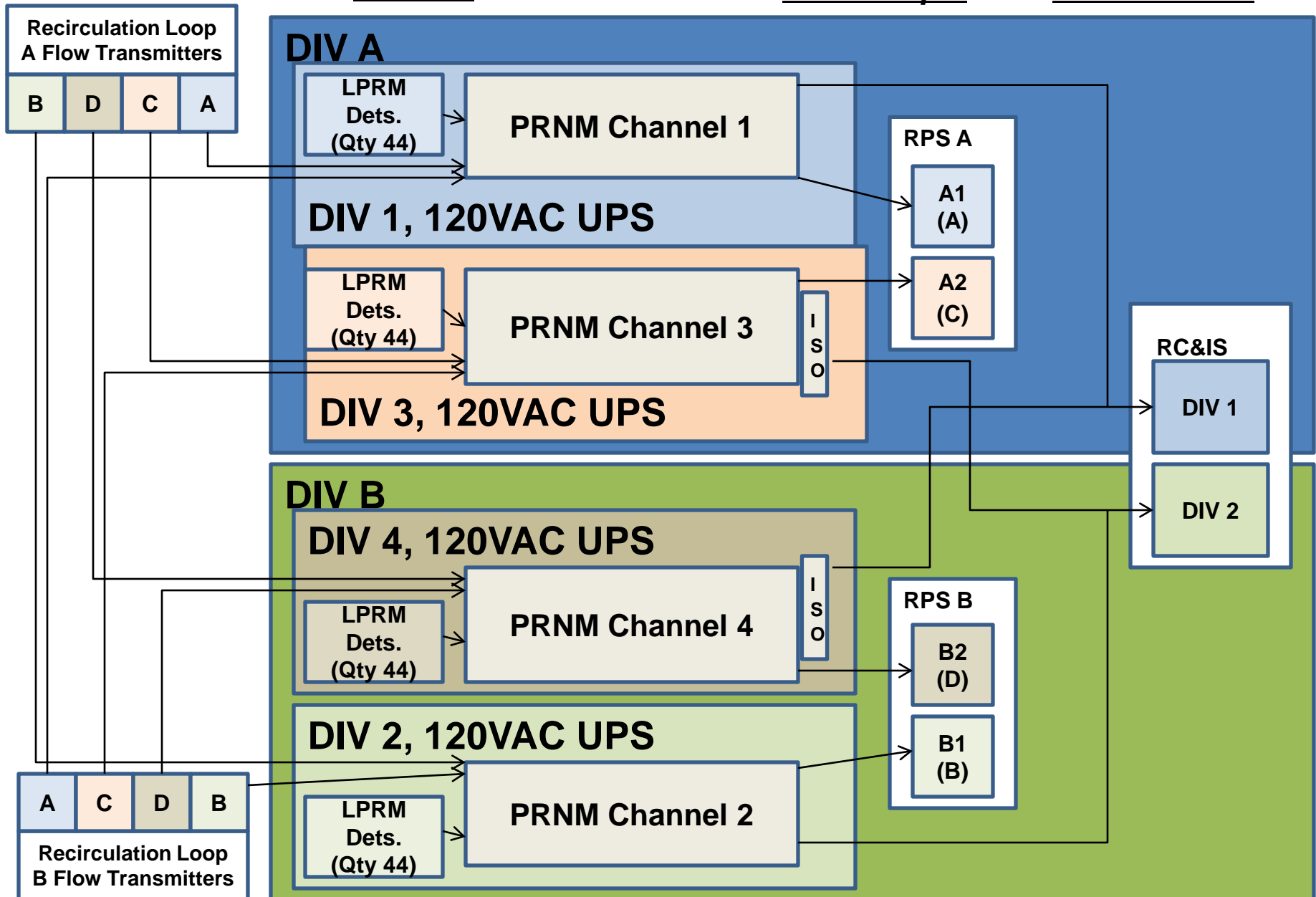
- Meets independence requirements for electrical power, electrical isolation, and reliance upon sources that originate within the channel's safety division to satisfy the single-failure criteria:
 - Four independent PRNM channels
 - Two PRNM channels are assigned to each of two electrical safety divisions
 - Each PRNM channel:
 - Is powered from a 120 volt alternating current (VAC) uninterruptible power supply (UPS)
 - Processes sensors dedicated to the channel to create independent trip votes and rod blocks
 - Contains a 2-out-of-4 voter to independently perform coincidence logic on all channels' trip votes

PRNM Channel Context

Sensors

Voter Output

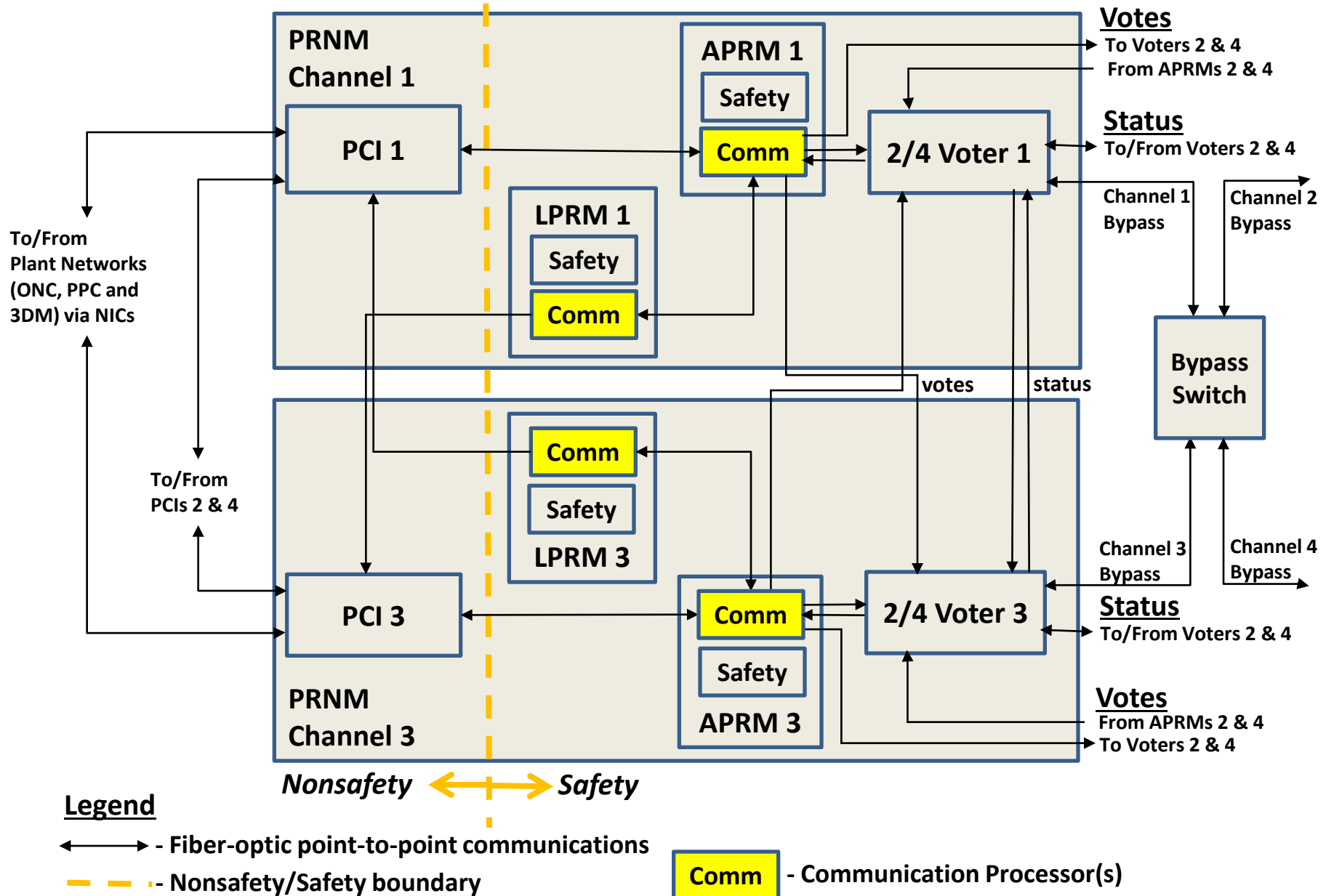
Rod Blocks



GGNS PRNM Equipment Configuration (cont'd)

- Interdivisional digital communication satisfies the applicable staff positions of DI&C-ISG-04:
 - No reliance upon resources that originate outside of each channel to perform its safety functions
 - Provides electrical and data isolation via:
 - Dedicated point-to-point fiber-optic communications
 - Communication processors that prevent communication activities from adversely affecting safety function processing
 - Implements deterministic communication protocols
 - Safety function processors are not burdened by performance of non-safety functions
 - No separate maintenance workstation
 - Software programs are fixed (not reprogrammable)

Interdivisional and Nonsafety/Safety Digital Communications



SWCCF and Diversity and Defense-in-Depth (D3)

- The licensee demonstrated that the potential for software common-cause failures within the PRNM system was adequately addressed and no plant vulnerability exists.
- The licensee performed its analysis per BTP 7-19, and it postulates a complete simultaneous failure of all four PRNM channels in conjunction with each design basis AOO and in conjunction with each design basis accident.
- The licensee's demonstration of compliance to BTP 7-19 justified no further action.
- The licensee also demonstrated compliance to DI&C-ISG-02 (Diversity and Defense-in-Depth Issues).

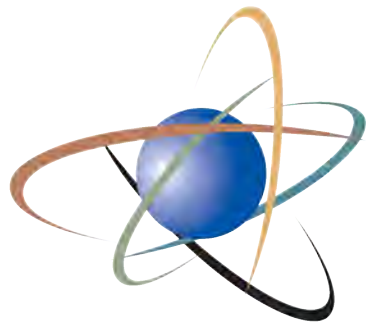
I&C Staff Conclusions

- Prior staff safety determinations remain valid for the GGNS PRNM retrofit:
 - Use of GEH NUMAC components per NEDC-321410P-A
 - Technical Specifications for the 4-channel configuration
- GGNS specifications and testing confirmed that the performance of the safety-related PRNM I&C is appropriately bounded.
- Safety channel independence is provided that ensures no adverse affect to safety functions from either non-safety equipment or interdivisional communications among channels
- SWCCF and D3 are adequately addressed

The proposed I&C changes are acceptable, because they meet applicable regulations and satisfy current and applicable I&C evaluation criteria thereby providing reasonable assurance of continued adequate protection of public health, safety and security.

Acronyms, Initialisms and Abbreviations

2/4	Two-out-of-Four	LPRM	Local Power Range Monitor
3DM	3-D Monicore	LTR	Licensing Topical Report
AOOs	Anticipated Operational Occurrences	LWR	Light Water Reactor
BWR	Boiling Water Reactor	NIC	NUMAC Interface Computer
BTP	Branch Technical Position	NUMAC	Nuclear Measurement Analysis and Control
APRM	Average Power Range Monitor	ONC	Orbital Network Computer
Comm	Communication Processor(s)	OPRM	Oscillation Power Range Monitor
D3	Diversity and Defense-in-Depth	PCI	PRNM System Communication Interface
Dets.	Detectors	PPC	Plant Process Computer
DI&C	Digital Instrumentation and Control	PRNM	Power Range Neutron Monitor
DIV	Division	Qty	Quantity
EPU	Extended Power Uprate	QVPLS	Quad Low Voltage Power Supply
GE	General Electric	RC&IS	Rod Control and Information System
GEH	General Electric-Hitachi	RPS	Reactor Protection System
GGNS	Grand Gulf Nuclear Station	SWCCF	Software Common Cause Failure
I&C	Instrumentation and Control	UPS	Uninterruptible Power Supply
ISG	Interim Staff Guidance	VAC	Volt Alternating Current
ISO	Qualified Isolation Device		



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Protecting People and the Environment

**Grand Gulf Nuclear Station, Unit 1
Extended Power Uprate
ACRS Subcommittee Meeting**

Vessel & Internals Material Integrity

Dan Widrevitz

Vessel & Internals Integrity Branch

Reactor Vessel Embrittlement

- EPU increases total fluence on RV
- RV Material Surveillance Program,
Uses BWRVIP ISP, but not a host plant, still has 3 capsules in RV
- Meets Appendix G requirements for
P-T limits, USE projections, circ weld inspection exemption, significant margins remain

Internals and Core Support Materials

- EPU increases total fluence on RV Internals
- Top guide, shroud, and core plate all exceed IASCC threshold for susceptibility, managed under:
 - Core plate – BWRVIP-25
 - Top guide – BWRVIP-183
 - Shroud – BWRVIP-76
- BWRVIP-190, water chemistry –
HWC and NMCA implemented for mitigation of SCC

Conclusion

- EPU has minimal impact on RV embrittlement issues
- Three RVI components exceed threshold for IASCC, but adequately managed



QUESTIONS

Acronyms

BWRVIP – Boiling Water Reactor Vessels and Internals Project

HWC – Hydrogen Water Chemistry

IASCC – Irradiation Assisted Stress Corrosion Cracking

ISP – Integrated Surveillance Plan

NMCA – Noble Metal Chemical Application

P-T – Pressure-Temperature

RV – Reactor Vessel

RVI – Reactor Vessel Internals

SCC – Stress Corrosion Cracking

USE – Upper Shelf Energy

Grand Gulf Nuclear Station Extended Power Uprate



Entergy

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**Advisory Committee on Reactor Safeguards
Meeting of the Subcommittee on Power Uprates**

May 24, 2012

Agenda

- **Plant Overview**
- **EPU Overview & Plant Modifications**
- **Safety & Containment Analyses**
- **Power Range Neutron Monitoring**
- **Fuel & Core Design Topics**
- **Groundwater Monitoring**
- **Mechanical Impacts**
- **Steam Dryer (*Closed Session*)**

Mike Perito

Mike Krupa

Greg Broadbent

Thomas Thornton

Fred Smith

Jerry Burford

Thomas Thornton

Steve Verrochi



Grand Gulf Nuclear Station

Extended Power Uprate

Introduction

Mike Perito

Site Vice President



Entergy

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Grand Gulf Nuclear Station Overview

Operating License issued on November 1, 1984

Full Power Commercial Operation commenced on July 1, 1985

GE BWR 6 - Mark III Containment

Original Licensed Thermal Power Limit	3833 MWt
---------------------------------------	----------

1.7% App. K Uprate (MUR) Implemented in 2003 (CLTP)	3898 MWt
---	----------

15% OLTP (13.1% CLTP) EPU Planned for 2012	4408 MWt
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***EPU Project Team Staffed with Personnel Having
Extensive GGNS Plant Experience***



EPU

Project Overview

Modifications
Power Ascension Testing



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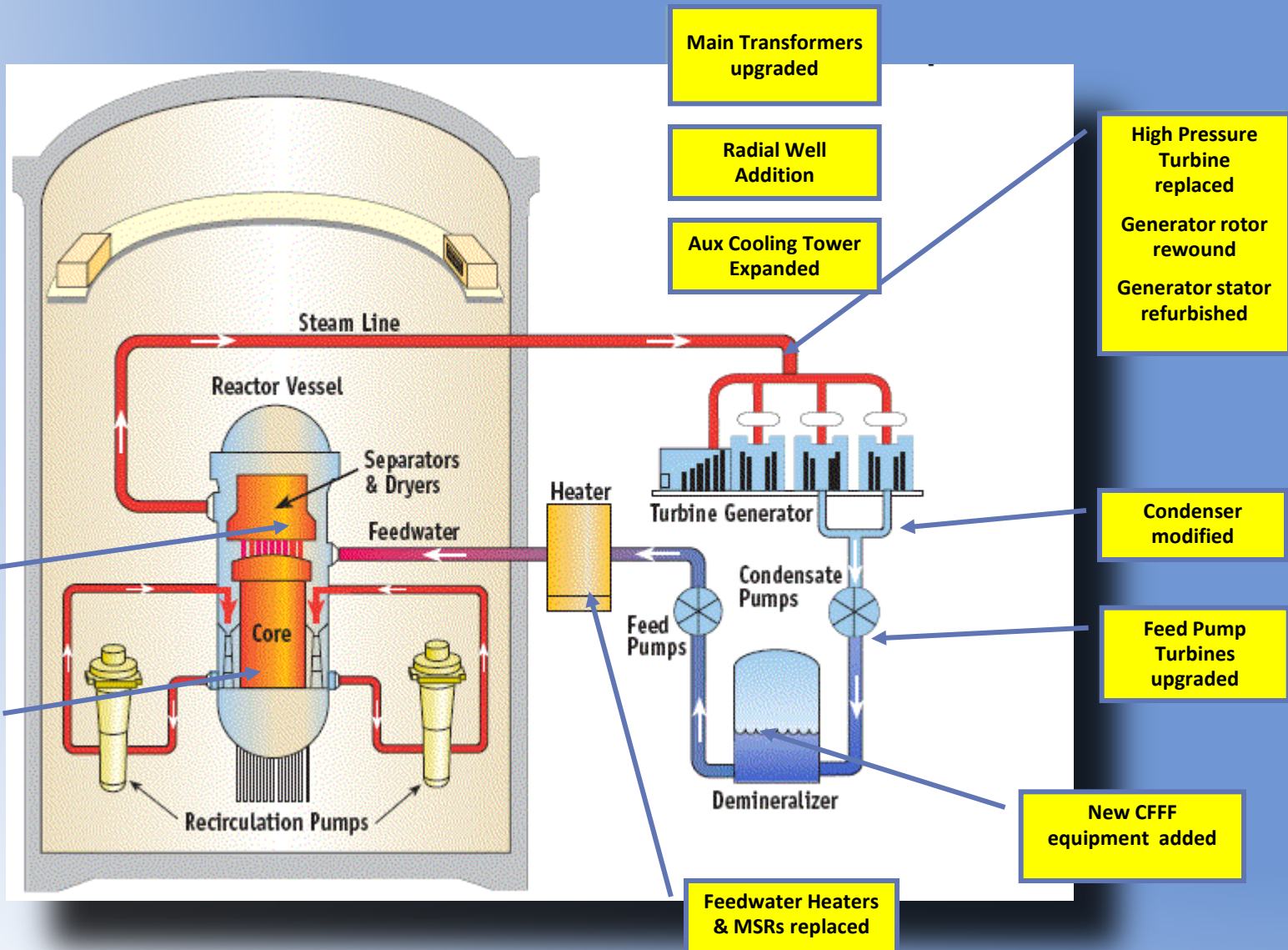
GGNS EPU Overview

- **EPU application based on GEH Extended Power Uprate Licensing Topical Reports**
 - **NEDC-32424 (ELTR-1)**
 - **NEDC-32523 (ELTR-2)**
 - **NEDC-33004 (CLTR)**
- **Constant reactor pressure uprate**
- **15% OLTP EPU considered optimum based on cost-effective hardware changes, fuel cycle capabilities, and prudent design and operating margins**

Overview of Major Parameter Changes

<u>Parameter</u>	<u>CLTP</u>	<u>EPU</u>
Core Thermal Power (MWt)	3898	4408
Full Power Core Flow Range (Mlbm/hr)	86.6-118.1	104.4-118.1
	77-105%	92.8-105%
Steam Dome Pressure Limit (psia)	1040	1040
Feedwater Flow Rate (Mlbm/hr)	16.74	18.935
Main Steam Flow Rate (Mlbm/hr)	16.774	18.968
Final Feedwater Temperature (°F)	420	420

Overview of Major Modifications



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Main Control Room
Power Range Neutron Monitoring System



**Moisture
Separator
Reheaters**



Aux Cooling Tower



Radial Well

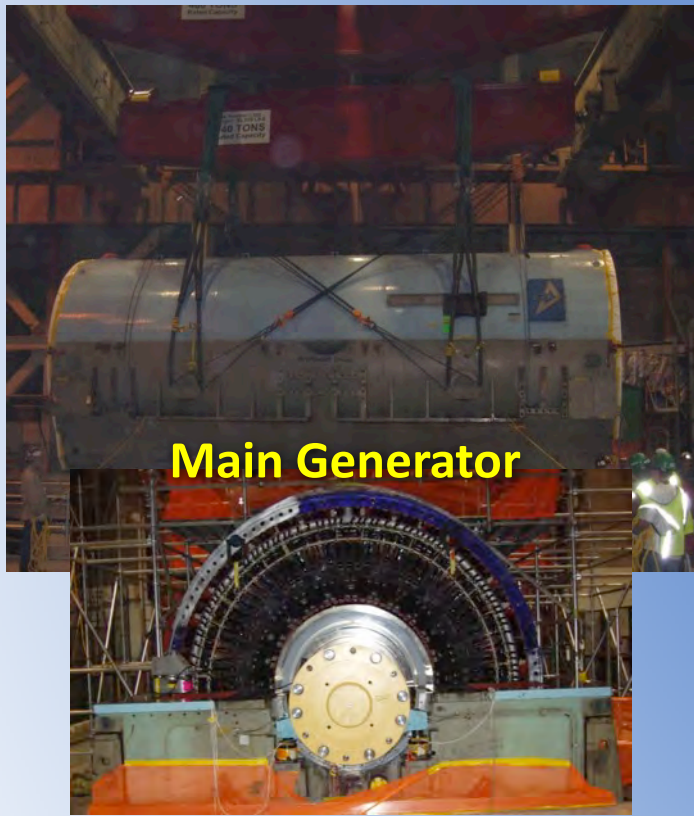


Main Transformers



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Main Generator



Steam Dryer



LP Feedwater Heaters



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Major EPU Modifications to Improve Safety and Transient Risk Margins

UHS (SSW) capacity improvements

Fuel Pool Cooling HX replacement

Steam dryer replacement

PRNMS installation

Condensate pump trip margin

SSW cooling tower fill replacement

PSW radial well addition

Enriched boron SLC system

Vibration Monitoring Equipment

Training and Simulator upgrades



Major EPU Modifications to Improve Reliability and Operating Margins

High pressure turbine replacement

Main generator rotor rewind

Generator cooling system upgrade

Stator refurbishment

Main transformer replacement

Transmission system upgrades

Iso-phase bus duct cooling upgrade

Feedwater heater replacements

Extraction steam pipe redesign

Moisture Separator Reheater replacement

Condenser tube staking

RFP turbine rotor/casing replacement

Condensate Full Flow Filtration

CCW HX tube cleaning system

Heater drain system LCVs

Auxiliary cooling tower expansion

Power Ascension Test Preparation

- EPU test plan developed in accordance with SRP 14.2.1
- Test plan consists of 12 individual tests
 - 11 tests from original startup testing scope
 - Transient testing consists of FW Controller and Pressure Regulator stability
 - Steam dryer monitoring plan
- Tests developed and performed by personnel experienced in GGNS testing

POWER ASCENSION MAJOR TESTING

Test	% CLTP									
	50	75	90	100	102.5	105	107.5	110	112.5	113.1
1A - Chemical and Radiochemical Sampling				X		X		X		X
1B - Dryer Performance (Moisture Carryover Determination)				X		X		X		X
2 - Radiation Monitoring				X		X		X		X
12 – APRM Calibration				X						
19 – Power Distribution Limits Verification			X	X		X		X		X
22 - Press Regulator Dynamic Testing			X	X		X		X		
23 - Feedwater Controller Dynamic Testing			X	X		X		X		
23 - Maximum Feedwater Runout Capability			X	X		X		X		X
24 – Turbine Stop and Control Valve Operability	40-65%	65-85%								
100 – Plant Vibration Monitoring	X	X		X	X	X	X	X	X	X
101 – Plant Parameter Monitoring			X	X	X	X	X	X	X	X
Steam Dryer Monitoring	X	X	X	X	X	X	X	X	X	X



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PAT Acceptance Criteria

- **Level 1 Acceptance Criteria - Associated with plant safety.**
- **If a Level 1 Test Criterion is not met:**
 - **The plant must be placed in a condition that is judged to be satisfactory and safe.**
 - **Issue documented in the Corrective Action Program with resolution immediately pursued.**
 - **Following resolution, the failed test must be repeated to verify the Level 1 requirement is satisfied.**
 - **A description of the problem must be included in the report documenting the successful test.**
- **Example: The maximum feedwater runout capacity shall not exceed the value assumed in the demand analysis for the maximum cycle-specific feedwater controller failure (i.e., protects fuel thermal limits).**

PAT Acceptance Criteria

- **Level 2 Acceptance Criteria - Associated with design performance.**
- **If a Level 2 Test Criterion is not met:**
 - **Plant operation or test plans adjusted as necessary to assure safety**
 - **Issue documented in the Corrective Action Program and evaluation of performance or equipment adjustments related to the criteria not met**
 - **This evaluation must include alternative corrective actions and concluding recommendations**
 - **Following resolution, the applicable test portion *may* be repeated to verify Level 2 requirement is satisfied**
- **Example: Feedwater flow capability should be at least 5% greater than the normal steady state operating feedwater flow rate at full EPU power to provide operating margin.**

Analysis

Safety Analysis
Containment Analysis
Operating Domain



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EPU Safety Analyses

Reload Analyses

- Load Reject No Bypass
- Turbine Trip No Bypass
- FW Controller Failure No Bypass
- Loss of FW Heating
- Rod Withdrawal Error
- Appendix K LOCA
- SLC Shutdown Margin

Containment Performance

- Main Steam Line Break
- Recirc Suction Line Break

Special Events

- Station Blackout
- Appendix R
- ATWS

Radiological Events

- LOCA
- Fuel Handling Accident
- Control Rod Drop

Limiting Events

Criteria	Limiting Event	Result CLTP / EPU	Limit
Suppression Pool <ul style="list-style-type: none"> ○ Temperature (no debris) ○ Temperature (w/debris) 	SBO LOCA	186.9 / 200.1 °F 181 / 189 °F	210 °F 194 °F
Drywell <ul style="list-style-type: none"> ○ Temperature ○ Pressure 	MSLB (LB)	330 / 307 °F* 22 / 27 psig	330 °F 30 psig
Containment <ul style="list-style-type: none"> ○ Temperature ○ Pressure 	RSLB MSLB RSLB	181 / 142 °F 11.5 / 14.8 psig (ST) 11.5 / 11.9 psig (LT)	185 °F 15 psig 15 psig
Core Parameters <ul style="list-style-type: none"> ○ Peak Clad Temperature ○ Peak Vessel Pressure 	RSLB MSIVC ATWS	1676 / 1675 °F 1387 / 1455 psig	2200 °F 1500 psig

* Small SLB results unaffected by EPU. Peak SSLB DW temp remains at 330 °F



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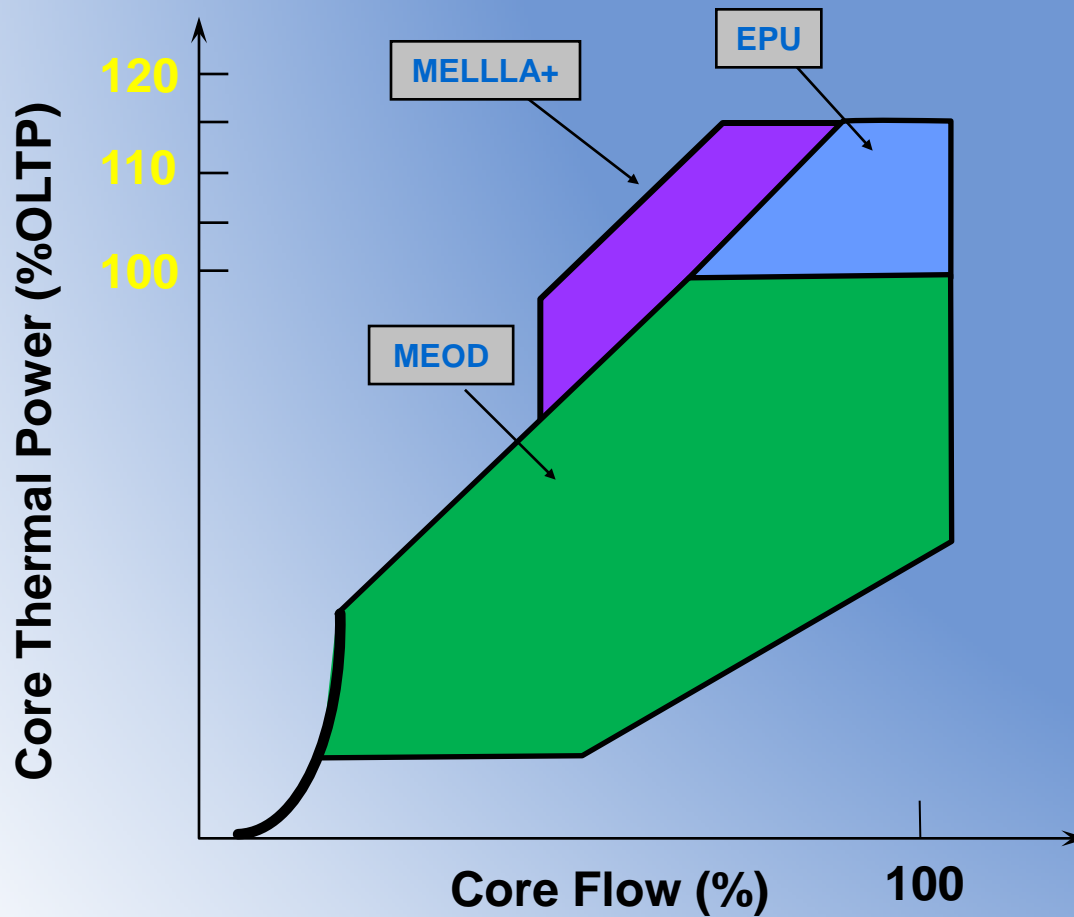
ECCS Net Positive Suction Head

- **No credit for containment accident pressure**
- **Positive margins to pump curves**

Station Blackout

- **Current Licensing Basis**
 - NUMARC 87-00 Methodology
 - 4- hour AC-independent coping period
- **EPU Impacts**
 - Higher EPU Decay Heat leads to:
 - Increased Drawdown of CST Inventory
 - More SRV cycles - higher compressed air usage
 - Increased Temperature/Pressures in Drywell and Containment
- **EPU Results**
 - Increased CST water requirements within current tank inventory
 - Additional SRV cycles within current accumulator capacity
 - Peak Drywell/Containment temperatures within design limits

Power-Flow Map



MELLLA+ = Maximum Extended Load Line Limit Analysis - Plus

EPU = Extended Power Uprate

MEOD = Max. Ext. Op. Domain

OLTP = Original Licensed Thermal Power

Power Range Neutron Monitoring System

Stability



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Power Range Neutron Monitoring System

- Power Range Neutron Monitoring System (PRNMS) is a modern digital neutron monitoring system that replaces the current analog reactor core power monitoring system.
- This new system supports:
 - Plant operation at higher power levels by providing digital accuracy, redundancy, improved response times and scram avoidance.
 - A different core stability solution needed for extended power uprate conditions.
 - GGNS switching from BWR Option EIA to Option III.
- PRNMS previously implemented at 15 US units.
- PRNMS approved; GGNS OL Amendment 188, March 28, 2012.

Power Range Neutron Monitoring System

- PRNMS utilizes some current components:
 - Local Power Range Monitors
 - Reactor Recirculation flow transmitters
 - Rod Control & Information System
 - Reactor Protection System
 - Associated recorders and meters
 - Plant process computer and associated interfaces
- New equipment in the control room includes:
 - APRM instrumentation modules
 - PRNM Communication Interface modules
 - Voter Logic Modules
 - Associated low voltage power supplies
- Includes new Oscillation Power Range Monitor

Stability

- **Option III solution applied**
 - Oscillation Power Range Monitor (OPRM) enables transition from Option EIA to Option III
- **OPRM trip-enabled region rescaled with EPU**

Nuclear Fuel Topics

Fuel & Core Design
Fuel Thermal Conductivity Degradation
Criticality Safety Analysis



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Fuel & Core Design

- **Core Design**
 - **GGNS C19: 800 assemblies**
 - **364 fresh reload GNF2**
 - **308 once-burned GNF2, and**
 - **128 twice-burned GE14**
 - **All GE14/GNF2 bundles have**
 - **PCI resistant barrier cladding**
 - **‘Defender’ lower tie plate debris filter design**
 - **Zr4 120/75 mil channels**
 - **Cycle 19**
 - **Core design and reload evaluations complete**
 - **Supplemental Reload Licensing Report complete**

Fuel & Core Design

- **Confirmatory Evaluations:**
 - **SER for NEDC-33173P-A Rev.1 imposes 24 limitations and conditions for application of GNF methods to expanded operating domains**
 - **13 of 24 are applicable to GGNS EPU**
 - All 13 are met
 - **11 of 24 are not applicable to GGNS EPU**

Fuel Thermal Conductivity Degradation

- **PRIME T-M methods fully address the TCD subject (approved 2010)**
- **EPU performed consistent with the PRIME LTR**
 - PRIME-based Thermal-Mechanical Operating Limit
 - Transition of downstream methods per approved Implementation plan

SFP Criticality Safety Analysis

- **EPU LAR noted Criticality not impacted by EPU**
 - Demonstrate GDC 62 using cycle-specific evaluations
 - GGNS utilizes neutron absorber materials in racks
 - Condition of absorber subject to monitoring program
- **New CSA under NRC review**
- **Conservative License Condition to be imposed while staff completes review of CSA**

Groundwater Monitoring

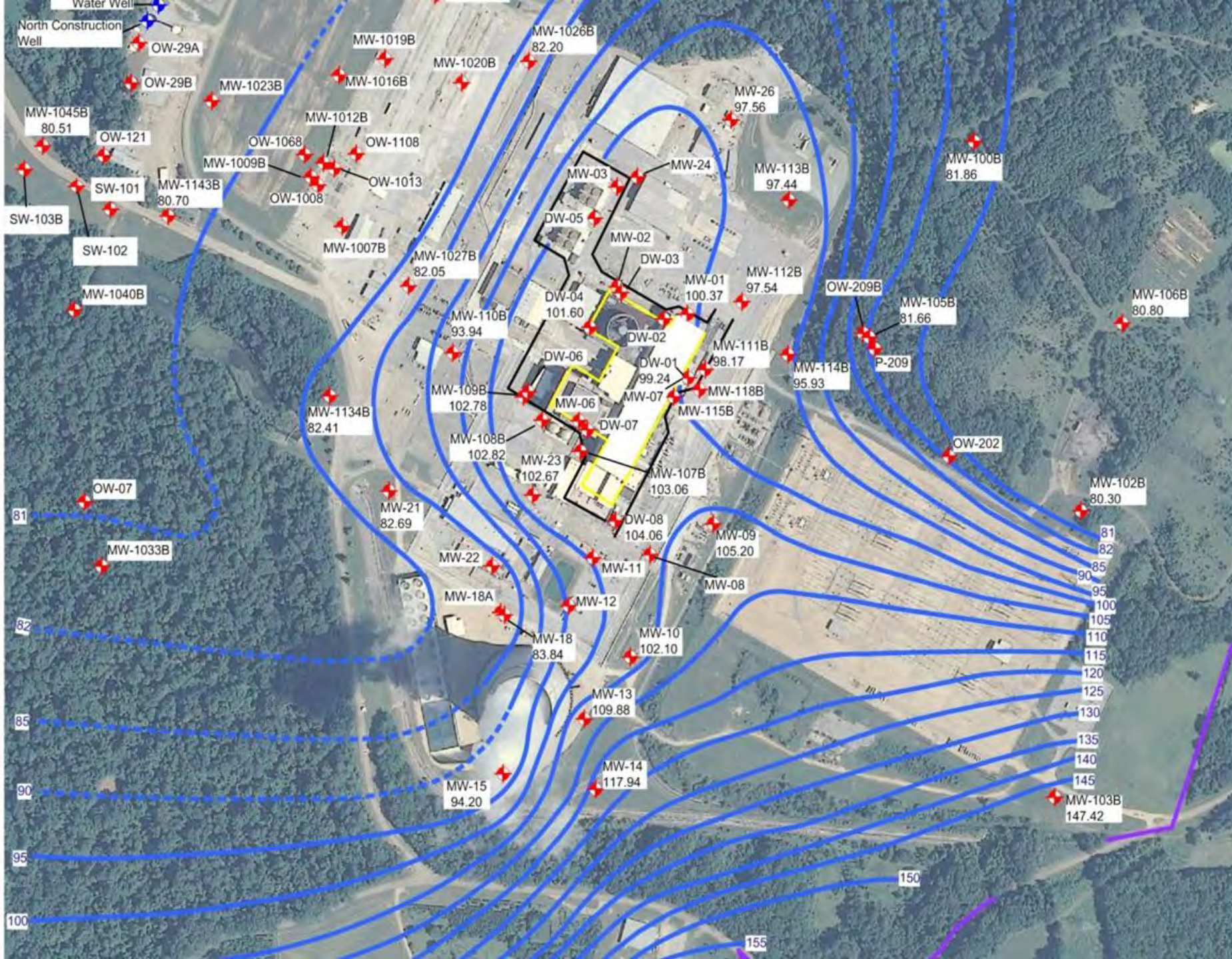


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GGNS Groundwater Monitoring

- **Entergy has implemented the NEI Groundwater Protection Initiative (NEI 07-07)**
- **Elevated tritium activity identified in May of 2010 as part of the station's expansion of our ground water monitoring program**
- **Current data from an independent hydrology company indicates a 1997 spill of tritiated water as the source of activity**
- **Spill was reported in the 1997 Annual Radiological Effluent Release Report**



GGNS Groundwater Monitoring

- The site has added 19 monitoring wells to the 83 existing wells to establish better defined hydrology and bound the plant perimeter.
- Actions have been developed with our independent hydrologist for additional well installation and monitoring .
- Communication protocol in place with state and local agencies

Mechanical Impacts

**Flow-Induced Vibration
Reactor Vessel Structural Topics
IGSCC / IASCC**



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EPU Flow Induced Vibration – RPV Internals

- **Maximum core flow is not increased by EPU**
- **Feedwater and Steam Flows increase ~13%**
- **Analysis results concluded FIV loads at EPU meet acceptance criterion of 10 ksi peak stress intensity**
- **Structural Integrity of Reactor Internal components confirmed**

EPU Structural Effects – RPV Internals

- **Design conditions not changed by EPU**
- **Installation of Replacement Steam Dryer will not affect structural integrity**
- **Stresses due to emergency and faulted conditions are based on loads such as RPV design pressure limit which did not change for EPU**
- **Stress analysis demonstrates EPU stresses still meet ASME Section III requirements**

RPV Structural Evaluation

The fatigue usage factors meet the ASME code requirements for the 40 year license with EPU. RPV components having a CUF > 0.50 that experience an increase in flow, temperature, RIPDs, or other mechanical loads were evaluated for fatigue as follows:

Component	CLTP CUF	EPU CUF	Allowable
FW Nozzle CS Safe End	0.732	0.886	1.0
FW Nozzle Stainless Clad Safe End	0.997	0.620*	1.0
FW nozzle	0.564	0.580	1.0
MS outlet nozzle	0.520	0.604	1.0
Rx recirculation inlet nozzle	0.564	0.685	1.0
Rx recirculation outlet nozzle	0.540	0.549	1.0

** EPU CUF value was reduced by fewer design cycles and FEA of critical transients.*

RPV Fracture Toughness and Materials

- **RPV meets 10 CFR 50 Appendix G requirements**
- **No material changes, except for the steam dryer**
- **Inspection requirements based on BWRVIP program**
- **Slight changes to temperature and flow for reactor coolant pressure boundary materials**
- **Current inspection strategy for RCPB is acceptable**