

# Official Transcript of Proceedings

## NUCLEAR REGULATORY COMMISSION

Title: Advisory Committee on Reactor Safeguards  
Power Upgrades Subcommittee:  
OPEN SESSION

Docket Number: (n/a)

Process Using ADAMS Template  
ACRS/ACNW-005  
SUNSI Review Complete

Location: Rockville, Maryland

Date: Friday, March 21, 2008

RECEIVED

APR 01 2008

Work Order No.: NRC-2076

Pages 1-223

ORIGINAL

NEAL R. GROSS AND CO., INC.  
Court Reporters and Transcribers  
1323 Rhode Island Avenue, N.W.  
Washington, D.C. 20005  
(202) 234-4433

T-RO4

ACRS OFFICE  
DO NOT REMOVE FROM FILE

DISCLAIMER

UNITED STATES NUCLEAR REGULATORY COMMISSION'S  
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

March 21, 2008

The contents of this transcript of the proceeding of the United States Nuclear Regulatory Commission Advisory Committee on Reactor Safeguards, taken on March 21, 2008, as reported herein, is a record of the discussions recorded at the meeting held on the above date.

This transcript has not been reviewed, corrected and edited and it may contain inaccuracies.

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

+ + + + +

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

+ + + + +

SUBCOMMITTEE ON POWER UPRATES

+ + + + +

FRIDAY, MARCH 21, 2008

+ + + + +

ROCKVILLE, MARYLAND

+ + + + +

OPEN SESSION

+ + + + +

he Subcommittee met in Open Session at the Nuclear Regulatory Commission, Two White Flint North, Room T2B3, 11545 Rockville Pike, at 8:30 a.m., Dr. Said Abdel-Khalik, Chairman, presiding.

SUBCOMMITTEE MEMBERS PRESENT:

- SAID ABDEL-KHALIK, Chair
- MARIO V. BONACA
- SANJOY BANERJEE
- J. SAM ARMIJO
- OTTO L. MAYNARD
- JOHN D. SIEBER

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25

CONSULTANTS TO THE SUBCOMMITTEE PRESENT:

GRAHAM WALLIS

TOM KRESS

ALLAN PIERCE

NRC STAFF PRESENT:

ZENA ABDULLAHI, Designated Federal Official

JOHN G. LAMB

KAMAL MANOLY

TOM SCARBROUGH

VIKRAM SHAH

PAT HYLAND

BOB PETTIS

MARTY STUTZKE

DONALD HARRISON

MATTHEW MITCHELL

MATT YODER

1     ALSO PRESENT:

2             PAUL DAVISON

3             BILL KOPCHICK

4             ED BURNS

5             PAUL DUKE

6             FRAN BOLGER

7             BRIAN MOORE

8             SHELLY KUGLER

9             ALAN BILANIN

10            ED SCHROLL

11            ALEX BOSCHITSCH

12            SAMIR ZIADA

13            STEVE HAMBRIC

14            BRANDON SWARLEY

15

16

17

18

19

20

21

22

23

24

25

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25

TABLE OF CONTENTS

Opening Remarks . . . . . 5

Safety Relief Valve Performance . . . . . 8

    P. Davison

Steam Dryer and Vessel Internals . . . . . 13

    P. Davison,

Steam Dryer and Vessel Internals

Mechanical and Civil Engineering . . . . . 59

    K. Manoly, T. Scarborough, J. Wu, V. Shah

Plant Systems

NRC Staff Review of EPU Test Programs . . . . . 114

Probabilistic Safety Assessment . . . . . 120

Risk Evaluation . . . . . 143

Materials and Chemical Engineering . . . . . 158

Electrical and Grid Reliability . . . . . 167

Electrical and I & C . . . . . 181

Source Terms and Radiological Consequences . . . 193

Public Comments/Committee Concluding

    Comments . . . . . 202

Adjourn

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

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

8:30 a.m.

CHAIR ABDEL-KHALIK: The meeting will now come to order.

This is the second day of a two day meeting of the Advisory Committee on Reactor Safeguards Power Uprate Subcommittee's review of the Hope Creek Generating Station extended power uprate application.

The purpose of this meeting to hear presentations by and hold discussions with the Hope Creek licensee, PSEG, the NRC staff, their consultants and other interested persons regarding the proposed EPU.

The Subcommittee will gather information, analyze relevant issues and facts and formulate proposed positions and actions as appropriate for deliberation by the full Committee.

Zena Abdullahi is the designed Federal Office for this meeting.

Parts of this meeting will be closed because the material to be presented is considered priority by the applicant and/or its contractors, General Electric-Hitachi and Continuum Dynamics Incorporated.

1                   The proposed times for the closed sessions  
2 are identified in the agenda.

3                   Attendees who are required to leave during  
4 the closed sessions can call 301-415-7360 to obtain a  
5 status report as to when they can rejoin the meeting.

6                   We received the request for a  
7 teleconference from Mr. Jerry Humphreys who represents  
8 the State of New Jersey. A bridge telephone number  
9 was made available.

10                  Having signed the relevant proprietary  
11 agreement with Continuum Dynamics Incorporated. Mr.  
12 Humphreys should be able to participate in today's  
13 closed session discussions of the steam dryer based on  
14 CDI's analyses and methodologies. Please note that  
15 the bridge connection is only for listening in.

16                  A transcript of the meeting is being kept  
17 and will be made available as stated in the *Federal*  
18 *Register* notice. It's requested that speakers first  
19 identify themselves and speak with sufficient clarity  
20 and volume so that they can be readily heard.

21                  Before we get started, I'd like to point  
22 out that based on yesterday's presentation there  
23 appears to be an error in section 1.5 of the Safety  
24 Evaluation Report where the statement is made that  
25 independent confirmatory calculations were performed

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

(202) 234-4433

www.nealrgross.com

1 by the NRC staff on long term containment temperature  
2 response for a LOCA.

3 MR. LAMB: This is John Lamb of the NRC.

4 We agree with that assessment and it does  
5 not change your conclusions of the safety evaluation.

6 CHAIR ABDEL-KHALIK: Thank you.

7 We will now proceed with the meeting. And  
8 I call upon PSE&G to start the meeting.

9 MR. DUKE: Thank you, Mr. Chairman. This  
10 is Paul Duke.

11 There were a couple of items for which we  
12 said we would provide additional information from  
13 yesterday's meeting, one having to do with exit  
14 quality and the other having to do with SRV and ECCS  
15 operating experience. And I would ask General Electric  
16 to address the first issue.

17 MR. MOORE: This is Brian Moore of Global  
18 Nuclear Fuel.

19 The question was given a core average exit  
20 void fraction, exit void fraction of 77 percent, what  
21 is the quality. And that would be about 20 percent,  
22 slightly higher in the periphery. And this is before  
23 mixing with the bypass.

24 CHAIR ABDEL-KHALIK: Thank you.

25 MR. DAVISON: Okay. I'd like to continue

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 on with the follow up information, the first topic  
2 being the question regarding the licensee's ability to  
3 ensure that the analysis required over pressure  
4 protection is maintained.

5 A brief description of Hope Creek's 14  
6 safety relief valves, you see the four or five and  
7 five sets of different pressures with the associated  
8 plus and minus 3 percent tolerances that go along with  
9 those SRVs.

10 We did in 1998 a -- tech spec change. Hope  
11 Creek, like many other sites, were experiencing  
12 repetitive out of tolerance setpoint test results.

13 Additionally, we proceeded with the  
14 industry on the next page through the Boiling Water  
15 Owners' group implementation of changes to improve our  
16 safety relief valve performance. The setpoint,  
17 repeatability and the main seat leakage were both  
18 addressed through modifications and improved  
19 maintenance practices.

20 Under the SRV performance, that's post-  
21 1998 when we changed from 1 percent to 3 percent  
22 tolerance, you'll see the number of failures and the  
23 various tolerances that were exceeded listed for cycle  
24 8 through 13. The modification and maintenance  
25 practices were implement, as the dotted line shows, in

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 the 2006 refuel outage. Our last refuel outage, which  
2 was September of 2007, we removed valves and performed  
3 setpoint testing for tech specs. You see that the  
4 modifications that were done both the Stellite-21  
5 pilot valve upgrade as well as the more refined  
6 maintenance practices with respect to seat lapping has  
7 paid off with zero failures of our first round of  
8 testing following our modifications.

9           Although the modifications appear to be  
10 successful, our continued testing each refuel outage  
11 will closely monitor those valves to ensure that the  
12 results are consistent.

13           When we do have failures we're required  
14 per our tech specs to submit any LER for greater than  
15 one valve should it vale or outside the tolerance. And  
16 that requires an assessment of the over pressure  
17 protection capability.

18           GE performed a bounding analysis that  
19 included one nonfunctional safety relief value. That's  
20 permitted by tech specs. And 13 of the remaining, all  
21 of the remaining which are 13 SRVs set to lift at 1250  
22 psig, which correlates to approximately 7½ percent  
23 greater than the highest range setpoint as allowed by  
24 the plus 3 percent tolerance. The results of that did  
25 conclude that there is positive margin to ensure that

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 we continue to have the over protection.

2           Additionally, margin not included in this  
3 bounding analysis still exists due to the low feature  
4 on two of the SRVs that Bill Koopchick spoke about  
5 yesterday in his operations presentations. Essentially  
6 that's at 1047 spig, two of our SRVs, the Hotel and  
7 Papa or H&P SRVs control automatically at a lower  
8 pressure. Again, that credit was not applied to that  
9 bounding analysis.

10           So in conclusion, the SRV performance  
11 deficiencies were recognized. We did pursue  
12 improvements through the industry. We implemented the  
13 modifications and we have seen improved results with  
14 respect to our surveillance setpoint checks of the  
15 SRVs.

16           MEMBER BONACA: The reason why I asked the  
17 question yesterday was because the concern that flow-  
18 induced vibrations may deteriorate performance  
19 further.

20           MR. DAVISON: Correct.

21           MEMBER BONACA: Do you have any  
22 information regarding sister plants that have in fact  
23 have operated and how their performance of the SRVs  
24 has changed because of that?

25           MR. DAVISON: We do. We did benchmark

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 specifically for that concern. We had the data from  
2 Quad Cities, who had instrumented their electro-matic  
3 relief valves. And, in fact, that is why we have our  
4 SRVs, both the body of the SRVs at the pilot valve--

5 MEMBER BONACA: Yes.

6 MR. DAVISON: -- and also at the tailpipe  
7 for vibration so that we have our baseline data, which  
8 is well below the .1 g RMS value, and we don't expect  
9 it to go anywhere near that specific limits.

10 MEMBER BONACA: You say for sister plants  
11 performance has not degraded? Going up? You don't  
12 know?

13 MR. DAVISON: Based on set point  
14 tolerances?

15 MEMBER BONACA: Well, in general, yes.  
16 Well, that would be the issue?

17 MR. DAVISON: Do we have specific  
18 information on that that we can provide right now?

19 We have the general benchmarking, but with  
20 respect to failures or setpoint changes coming out of  
21 EPU we have not seen a trend. But I don't have that  
22 specific information. We can certainly follow up with  
23 that.

24 MEMBER BONACA: It would be valuable.

25 MR. DAVISON: Yes.

1 Other questions on SRVs?

2 We have the follow up just to specifically  
3 identify plants that have previously updated to see if  
4 they've had any degradation or change in their SRV  
5 performance with respect to setpoints or tailpipe  
6 leakage.

7 MEMBER BONACA: I got it. That's good.

8 MR. DAVISON: Okay. A similar question  
9 was asked of the ECCS system with regard to the ECCS  
10 system operation and reliability to support the  
11 licensing and design functions. Tech specs govern  
12 operation with combination of HPIC, RCIC, RHR and core  
13 spray being out of service.

14 Both of our high pressure and low pressure  
15 system unavailability, which we track and report, is  
16 closely guarded and monitored at Hope Creek. We  
17 continue to have top quartile performance, which is  
18 the norm for the station, and the number is listed  
19 there.

20 And finally, our quarterly IST flow tests  
21 of the pumps mentioned and the training of those  
22 results have been satisfactory. And, in fact, we have  
23 no pumps on increased frequency, which would be a sign  
24 of some of type degradation. So there are no pumps in  
25 that category.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 CHAIR ABDEL-KHALIK: Thank you.

2 MR. DAVISON: You're welcome.

3 CHAIR ABDEL-KHALIK: Are there any  
4 questions about these two issues?

5 We will now proceed with the normal  
6 presentation, which is item 15 on the agenda.

7 MR. DAVISON: And I failed to introduce  
8 myself when I started. My name is Paul Davison and  
9 I'll actually in this session be discussing the Hope  
10 Creek reactor vessel internals and the steam dryer.

11 This is an open session, which will be  
12 followed by a closed session to discuss proprietary  
13 information.

14 Starting with reactor vessel internals,  
15 I'll discuss the EPU, effects on neutron fluence,  
16 flow-induced vibration, structural integrity, IGSCC  
17 and vessel internal inspection programs.

18 On page 3, start off with the IASCC or  
19 irradiation-assisted stress corrosion cracking. The  
20 increase in fluence did not result in additional  
21 components exceeding the threshold for IASCC. In fact,  
22 the shroud, top guide and the dry tube assemblies all  
23 previously exceeded the IASCC threshold.

24 With specifics on the shroud, it is  
25 inspected in accordance with BWRVIP-76. In 1997

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 baseline inspection was completed with no flaws. The  
2 ten year inspection was completed in 2007. Six minor  
3 flaws were identified that did not impact structural  
4 integrity. Reinspection is scheduled for ten years,  
5 which is the norm for BWRVIP-76.

6 The top guide inspection, it will be  
7 conducted in accordance with the recently issued  
8 BWRVIP-183 documentation. And that will commence in  
9 our next outage, which is in the spring of 2009. Four  
10 locations will be inspected in 2009 with ten percent  
11 of all the locations being completed within 12 years  
12 per the guidelines that are outlined in the VIP  
13 documentation.

14 And the incore dry tube assemblies, all 12  
15 dry tubes were replaced in the year 2000. And that was  
16 due to cracking. Less susceptible material was  
17 utilized during the replacement, and we will continue  
18 to inspect for the GE SIL 409 requirements, which is  
19 a 20 year.

20 MEMBER ARMIJO: What will you do if you  
21 find some indications in the top guide there of  
22 concern? Do you have a repair --

23 MR. DAVISON: There are a few plants. I  
24 believe it's Oyster Creek and Nine Mile 1 that have  
25 started the inspections. We have done previous

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 inspections, not to any great quality. You know, more  
2 of a kind of general overview of the top guide.

3 A single top guide beam failure or  
4 indication would not result in loss of geometry.  
5 Multiple would, in fact, do that. We do not have any  
6 specific contingency plans on our books, but part of  
7 our outage planning process will go out to look at  
8 other operators as well as General Electric to come up  
9 with contingency, either flaw handbook-type analysis  
10 to say what's good or what's not good and then the  
11 potential fixes that would have to be implemented to  
12 address anything that was found.

13 MEMBER BONACA: Well, what's the condition  
14 of your shroud?

15 MR. DAVISON: The shroud has minor flaws,  
16 as I mentioned.

17 MEMBER BONACA: Okay.

18 MR. DAVISON: The shroud itself was  
19 inspected in '97, zero flaws. 2007, re-baselined and  
20 we have five flaws, five minor flaws that didn't  
21 impact the structural integrity.

22 MEMBER ARMIJO: How do you define minor,  
23 just to calibrate?

24 MR. DAVISON: Minor in that --

25 MEMBER ARMIJO: About an inch long or--

1 MR. DAVISON: Yes. Some details on them.  
2 All less than 2 inches in depth, less than 15 percent  
3 throughwall. And then, you know, each one is a little  
4 bit different where it is, but in general that's the  
5 criteria. None of them exceeded that.

6 Okay. On the next slide, RPV internals.

7 The vessel internals are not adversely  
8 impacted by EPU operations.

9 Hope Creek vibration levels were  
10 extrapolated for operation at percent above the 3952  
11 megawatt thermal which a maximum rated core flow of  
12 105 percent. So highest power and flow conditions.

13 All components were well below GE's  
14 acceptance limit of the 10,000 psi. In addition, the  
15 jet pump sensing lines met the acceptance criteria of  
16 no resonance with recirc pump vane passing frequency.

17 MEMBER ARMIJO: What is the resonance  
18 frequency for these sensing lines?

19 MR. DAVISON: There's actual several of  
20 them. We validated during construction through finite  
21 element modeling as well as impact tests. We did have  
22 some criticals on 10 and 11 and 20 and jet pump 1,  
23 which are closest to the N1 recirc outlet nozzles. We  
24 also added a support to jet pump sensing line 11.

25 Do you have the specific frequency?

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. DUKE: I'd have to look up.

2 MR. DAVISON: Okay.

3 DR. WALLIS: Is it only the sensing lines  
4 you worry about? These recirc pump event passing  
5 frequency as is spread out throughout the whole  
6 system, isn't it?

7 MR. DAVISON: Yes, that's correct. But  
8 for the vessel internals perspectives, that's one of  
9 the major --

10 DR. WALLIS: These are the only lines you  
11 worry about for resonance?

12 MR. DAVISON: Internal to the vessel, yes.

13 DR. WALLIS: Only internals you worry  
14 about for resonance?

15 MR. DAVISON: Yes. The recirc piping, RHR  
16 piping, mainsteam line piping in the drywell is also  
17 being monitored via accelerometers that we talked  
18 about and we'll actually talk about it again with  
19 respect to dryer impact. But for the actual vessel  
20 internals, these are the only physical lines inside  
21 the vessel from the wall of the vessel to the jet  
22 pumps themselves, for the calibrated jet pumps.

23 Page 5. The RPV is not adversely impacted  
24 by EPU. The RPV components were screened against the  
25 criteria of fatigue usage factor in essence of 0.5.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 Three components required further  
2 evaluation. The main closure studs, the core shroud  
3 support and the core spray nozzle. Actually two of  
4 them, N5 alpha and bravo. All were analyzed to meet  
5 the requirements of ASME code with respect to stress  
6 and fatigue.

7 The three RPV nozzle weld overlays, we had  
8 one in '04, '07 and 1997, have all been modified and  
9 analyzed to be acceptable for EPU conditions. In fact,  
10 we did weld overlays on those three individual cases.

11 MEMBER ARMIJO: What is the maximum  
12 fatigue usage factor calculated for these components?

13 MR. DAVISON: For the studs, it was .755.  
14 For the core spray nozzle it was .796. And for the  
15 shroud support was .672.

16 MEMBER ARMIJO: Thank you.

17 MR. DAVISON: You're welcome.

18 MR. DAVISON: Okay. I'll move on to IGSCC  
19 on page 6.

20 Hope Creek's IGSCC program is not being  
21 changed by the implementation of EPU. There was a  
22 negligible change in the stress component. There are  
23 no material changes. And the corrosive environment  
24 changes will be mitigated via hydrogen adjustments,  
25 hydrogen injection adjustment rate -- hydrogen

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 injection rate adjustments to compensate for the  
2 increased oxygen generation at the higher power level.

3 MEMBER BANERJEE: How are the spargers  
4 arranged? Do they go all the way around?

5 MR. DAVISON: Core spray spargers?

6 MEMBER BANERJEE: No. I mean for the feed  
7 water. Don't you have spargers that distribute them?

8 MR. DAVISON: Yes.

9 MEMBER BANERJEE: And hydrogen is injected  
10 where exactly?

11 MR. DAVISON: Hydrogen is injected into  
12 the suction of the secondary condensate pumps. So it  
13 travels through the feed water system and is injected  
14 through the spargers.

15 MEMBER BANERJEE: Right. So do these  
16 spargers go all the way around or only partially the  
17 way around?

18 MR. DAVISON: They don't go 360. There's  
19 no individual lids, there is a gap on each end of  
20 them. I don't know if we have an actual picture of  
21 that. But they're not connected or 360 all the way  
22 around, but they're close to it.

23 MEMBER BANERJEE: And you have good  
24 evidence that the hydrogen mixes?

25 MR. DAVISON: Well, we were measuring our

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 ECP for protection that shows us that we've got good  
2 protection as far as running in the minus 489 to 490  
3 ECP range.

4 We also are pursuing -- right now our  
5 analysis allows us to inject down to approximately 25  
6 percent. We're actually pursuing modifications to our  
7 hydrogen water chemistry system as well as licensing  
8 change to allow us to inject down to 200 degrees so we  
9 can get more injection, more protection during startup  
10 phase of the vessel itself.

11 MEMBER BANERJEE: So now you're injecting  
12 more hydrogen for this few or --

13 MR. DAVISON: Yes. Going back in time a  
14 little bit when we first started injecting to get  
15 partial mitigation, we were in the approximately 30  
16 scfm range. In 2006 during the refuel outage we  
17 applied nobel metal, we had a noble metal chemical  
18 application. Coming out of that we reduced our  
19 hydrogen rates to approximately 8 scfm. So from 30  
20 down to 9, which also resulted in a significant  
21 radiological reduction.

22 Coming out of EPU, when we get to EPU  
23 power we will doing a full range of hydrogen injection  
24 testing for mitigation purposes. Are projections say  
25 that we will move from 9 to approximately 13 scfm. We

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 think our endpoint will be 13 scfm. So approximately  
2 4 additional scfm.

3 MEMBER BANERJEE: How do you measure the  
4 effectiveness of this hydrogen chemistry? Is there  
5 some quantitative measure?

6 MR. DAVISON: Through chemistry testing  
7 and also through our installed ECP and durability  
8 monitors that we installed as part of the noble metal  
9 chemical application.

10 MEMBER BANERJEE: And where are these  
11 monitors?

12 MR. DAVISON: Reactor water cleanup  
13 system. They take samples off of reactor water  
14 cleanup. So vessel-to-vessel water is what we're  
15 checking.

16 MEMBER BANERJEE: Okay.

17 MR. DAVISON: Page 7. In addition to the  
18 previously mentioned top guide inspection that I  
19 talked about, we'll also be following up with  
20 components in our inspection program and don't  
21 anticipate any effects related to EPU. Specifically  
22 the wedges, our jet pump wedges will be inspected in  
23 accordance with BWRVIP 41. The feedwater sparger and  
24 end brackets will continue to be inspected, as well  
25 the shroud head bolts.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           And if there are no additional questions  
2 on internals, I'll transition over to the dryer.

3           MEMBER BANERJEE: Could you just give us  
4 an idea of how the feedwater spargers are arranged and  
5 is it --

6           MR. DAVISON: Do we have a picture of the  
7 feedwater spargers that we can provide? That would  
8 probably be the easiest thing to give you. We'll  
9 provide that.

10          MEMBER ARMIJO: Please proceed.

11          MR. DAVISON: Page 8. Okay. The open  
12 discussion will cover the dryer's design, the design  
13 margin and the power ascension test plan associated  
14 with the steam dryer.

15                 The industry experience related to steam  
16 dryer failures is associated with plant specific dryer  
17 design, the main steamline piping velocities and  
18 acoustic resonance attribute to the main steamline  
19 piping configurations themselves. So in this  
20 morning's discussion we'll emphasize Hope Creek's  
21 robust design characteristics and our ample margin  
22 that exists.

23                 I'd like to start off on the next slide  
24 just talking about the dryer itself.

25                 Hope Creek's steam dryer was manufactured

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 to the ASTM material standards, the ASME welding  
2 standards and General Electric's design criteria to  
3 ensure structural integrity. However, it is not a  
4 safety related component.

5 Hope Creek's curved hood dryer is the  
6 third generation of steam dryers designed by General  
7 Electric. It's an improvement over the square hood  
8 design that failed Quad Cities. The curved hood  
9 design creates less turbulent steam flow through the  
10 dryer and into the main steamlines, which reduces  
11 dryer operating stresses. That will be in detail in  
12 the closed session.

13 Additionally, the dryer design was  
14 enhanced prior to initial operations at Hope Creek.

15 CHAIR ABDEL-KHALIK: What was the  
16 modification for that modification at the time?

17 MR. DAVISON: At the time, and actually  
18 cover that on the next slide, but it was driven by  
19 industry operating experience. And I'll go actually  
20 through every modification that we did on the next  
21 slide.

22 We have implemented the requirements of  
23 BWRVIP-139 for inspections. The baseline inspections  
24 were completed during the RF-12 and 13. So the prior  
25 two outages to last year's fall outage.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1                   So I'll go to slide 10 right now and  
2 actually show the actual modification.

3                   MEMBER BONACA:     How long have the  
4 operations been going on with this when you did the  
5 inspection?

6                   MR. DAVISON:   Well --

7                   MEMBER BONACA:   How long had the dryers  
8 been in operation when you did the inspections?

9                   MR. DAVISON:   From initial operations in  
10 '86 to the 2004.   The whole operating life of the  
11 plant.   Once we modified the dryer and installed it  
12 and started up the plant, we had not touched the  
13 dryers as far as modifications, with one minor  
14 exception that I'll talk about right now.

15                   This is a picture of the steam dryer with  
16 pre-operational enhancements that I talked about mods  
17 shown in the red colors.   The General Electric approved  
18 modifications were installed to address operating  
19 experience specifically from Toaki and, actually,  
20 Susquehanna.

21                   The outer hood material thickness was  
22 increased from 1/8th inch to 1/2 inch.   The center  
23 outlet plenum material thickness was increased from  
24 3/16th to 1/2 inch thickness.   The tie bars on top,  
25 the material thickness was increased from 1/2 inch by

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 1 inch cross section to 2 inch by 2 inch cross  
2 section. And we increased the number of the tie bars  
3 from 23 to 37.

4 The inner and middle hood to end plant  
5 joints were reenforced with external strips and  
6 internal backing welds. The strips are 3/16th by 2  
7 inch wide stainless steel that were welded to the end  
8 of the hood but overlapping the joint to the end  
9 plate. The back weld was performed on the inside of  
10 the hood for additional strength. Obviously, we could  
11 do this because it was not irradiated. It was before  
12 we did initial operations.

13 And finally, the dryer leg support leg  
14 located on the internal diameter of the vessel not  
15 shown on this picture were leveled to prevent dryer  
16 rocking. And we actually did conformational tests  
17 prior to startup so we didn't have an uneven sitting  
18 dryer.

19 No other modifications or repairs have  
20 been made since startup with the exception of the  
21 lifting rod. Can we point that out? The lifting rod  
22 bracket, which was removed in our refill outage 12  
23 that was due to a mishandling event. We actually  
24 caused a crack so we removed it.

25 The steam dryers' original design and

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 subsequent enhancements result in a very robust design  
2 for our EPU load conditions.

3 Okay. Now I'd do a little --

4 DR. WALLIS: The unused dryer which was  
5 tested --

6 MR. DAVISON: Yes.

7 DR. WALLIS: -- was that the same as this?  
8 Did it have the same modifications or what was it  
9 like?

10 MR. DAVISON: The steam dryer that was  
11 essentially abandoned, but we still had it, did not  
12 have all these modifications put into it since it was  
13 never --

14 DR. WALLIS: And it was the original  
15 dryer?

16 MR. DAVISON: That is correct.  
17 Nonmodified, yes.

18 This slide shows a comparison of Vermont  
19 Yankee, Quad Cities and Susquehanna units as compared  
20 to Hope Creek.

21 CHAIR ABDEL-KHALIK: But how do these  
22 modifications compare with the new Susquehanna dryer  
23 design?

24 MR. DAVISON: Well, I believe the design  
25 itself is different versus just an updated with these

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 mods.

2 Do we have the specifics of Susquehanna's  
3 -- or GE's design?

4 MR. PIERCE: Can I ask a question? Allan  
5 Pierce, ACRS consultant.

6 Do you have access to that sort of  
7 information as to what Susquehanna does? Do you know?  
8 Is it something that you've driven to --

9 MR. DAVISON: We do not have the  
10 specifics. We do not have the specifics of the actual  
11 dryer itself.

12 MR. PIERCE: Okay.

13 MR. DAVISON: We know in general the  
14 things that they were focusing on for improvement.

15 DR. WALLIS: Well, we could ask GE.

16 CHAIR ABDEL-KHALIK: Is there anyone from  
17 GE who could answer this question? Okay.

18 MR. DAVISON: If it would please the  
19 Subcommittee, we can do further research with GE and  
20 see if we can get that information.

21 CHAIR ABDEL-KHALIK: That would be very  
22 helpful. Thank you.

23 MR. DAVISON: Okay to continue?

24 MR. PIERCE: If I could ask a question?

25 MR. DAVISON: Sure.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. PIERCE: On your fourth column there  
2 you say "MSL branch line legs." I'm not familiar with  
3 all your terminology, but it seems like in Quad Cities  
4 there was something that resonated off the -- why  
5 didn't you have that mentioned in your table there?

6 MR. DAVISON: I'll actually go through  
7 that right now.

8 MR. PIERCE: Okay.

9 MR. DAVISON: We're going to talk about  
10 the differences of both Quad Cities and Susquehanna.

11 It may seem like branch legs is a little  
12 bit more generic design, which we don't have.

13 MR. PIERCE: Right.

14 MR. DAVISON: The electro-matic relief  
15 resonance to the stand pipes for those relief valves  
16 were specific to Quad Cities. But I'll cover both of  
17 those actually.

18 MR. PIERCE: Okay.

19 MR. DAVISON: So walking through this  
20 specific table here of the Hope Creek comparison to  
21 the other facilities, our flow velocity, steam flow  
22 velocity is comparable to Vermont Yankee and the  
23 Susquehanna unit, but significantly lower than Quad  
24 Cities.

25 Quad Cities experience acoustic resonance

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 at approximately 130 to 150 Hertz attributed to their  
2 electro-matic relief valve stand pipes. At CLTP Hope  
3 Creek does not experience any acoustic resonance. The  
4 Hope Creek SRV stand pipe diameters are larger,  
5 nominally 8 versus 6 inches at Quad and our main  
6 steamline flow velocities are lower, making us less  
7 susceptible to that whistling effect across the stand  
8 pipe.

9 The larger diameter and lower velocity  
10 results in the lower predicted stand pipe resonance.  
11 So, again, we will be monitoring that on our power  
12 ascension.

13 Susquehanna experienced acoustic resonance  
14 down at the 15 Hertz range. And that's attributed to  
15 the main steamline branch dead legs. Hope Creek does  
16 not utilize the main steamline dead legs for SRV  
17 connection pointed and does not experience the low  
18 frequency resonance.

19 So overall, Hope Creek --

20 MEMBER BONACA: Excuse me. Is it clear  
21 that Susquehanna is due to that or is it vortex  
22 shedding? Is there a clear understanding of this 15  
23 Hertz --

24 MR. DAVISON: Yes. In fact, we'll be  
25 showing some information in the proprietary session

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 that compares the actual steam lines with dead legs  
2 and without where you see the specific change. And  
3 that will be covered in the proprietary session.

4 So overall Hope Creek's lower steam  
5 velocity, absence of the main steamline branch dead  
6 legs and the curved hood design results in no main  
7 steamline acoustic resonance experiencing at CLTP. And  
8 this will be closed monitored during the power  
9 ascension and we'll cover it in greater detail in the  
10 closed session.

11 I'd like to just show a picture of our  
12 configuration for comparison. And not compared here  
13 are the different size for the stand pipes to Quad  
14 Cities, but it does specifically point out the dead  
15 legs.

16 The actual flow path for the steam, the  
17 steam dryers positioned with its vane banks  
18 approximately perpendicular to the main steamline  
19 nozzles. Alpha and bravo main steamlines are shown to  
20 the right, and the mirror images on the charlie and  
21 delta, or C and D, are on the left.

22 There are 14 Target Rock two-stage safety  
23 relief valves with identical stand pipe  
24 configurations. The alpha and delta main steamlines  
25 each of three SRVs, while the bravo and charlie each

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 have four SRVs.

2 Also note that the bravo main steamline  
3 has a blanked off stand pipe for a spare SRV location  
4 which is not used.

5 As discussed in the previous slide, we  
6 have no dead legs. However, you see in the dashed  
7 lines we show the specifics of where the dead legs  
8 and the SRVs would be mounted at Susquehanna. That's  
9 just for comparison, but we do not have that.

10 After the main steam stop valves, which  
11 are just beyond the outboard MSIVs, the main steamline  
12 diameter increases from 26 to 28 inch nominal, which  
13 is an atypical feature. This reduces flow and reduced  
14 vibration in the main steamlines.

15 For reference, our main steamline strain  
16 gauges are located, and the drawing's a little tough  
17 but we just wanted to show relatively height of the  
18 main steamlines in correlation to the vessel, on the  
19 upper and lower locations depicted here in the  
20 picture, the red lines.

21 CHAIR ABDEL-KHALIK: So the steamline  
22 velocities that you presented in the previous table  
23 correspond to which part of the steamline? The 26  
24 inch or the 28 inch?

25 MR. DAVISON: That's at the 26 inch

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 closest to the vessel where it impacts the vessel or  
2 the dryer ultimately.

3 MEMBER BANERJEE: Before the SRVs?

4 MR. DAVISON: Before the MSIVs.

5 MEMBER BANERJEE: Yes. Yes, also the SRVs,  
6 right?

7 MR. DAVISON: Yes. Through the steamline  
8 where the SRVs are located, that is correct.

9 MR. PIERCE: Can I ask a question?

10 MR. DAVISON: Yes.

11 MR. PIERCE: The steam dome, is that the  
12 top right, is that where it is, where the exit for the  
13 steam dome is? I'm trying to understand the figure.

14 MR. DAVISON: Yes. The smaller figure?

15 MR. PIERCE: Yes.

16 MR. DAVISON: That's a side review of the  
17 reactor vessel where the main steamline nozzles exit  
18 at the top and run down to where the SRVs are.

19 MR. PIERCE: Okay.

20 MR. DAVISON: So on top --

21 MR. PIERCE: Where are the strain gauges,  
22 two horizontal red lines?

23 MR. DAVISON: At each location where the  
24 redline intersects the main steamline, we have a band  
25 of eight strain gauges. So eight per those four

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 locations that are shown there.

2 MR. PIERCE: Are they circumferential?

3 MR. DAVISON: Yes, 45 degrees apart all  
4 the way around.

5 MR. PIERCE: Okay.

6 MEMBER MAYNARD: Okay. Back on that  
7 figure, just for the record I need to point out that  
8 the lettering on the handout shifted.

9 MR. DAVISON: Yes.

10 MEMBER MAYNARD: And so it'll end up in  
11 the record, you need to clarify that a little bit.

12 MR. DAVISON: Thank you. Yes. The B  
13 dropped down and shifted everything over so they don't  
14 line up. The correct orientation, which is on the  
15 slide, is C, D, A, B or charlie, delta, alpha, bravo.

16 Thank you.

17 CHAIR ABDEL-KHALIK: So if we go back to  
18 the table. Now this 167 feet per second corresponds  
19 to your 15 percent EPU, which is 116.6 original  
20 licensed power?

21 MR. DAVISON: Correct.

22 CHAIR ABDEL-KHALIK: The value given for  
23 Susquehanna is for their 20 percent power uprate.

24 MR. DAVISON: Correct.

25 CHAIR ABDEL-KHALIK: If at a future time

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 you were to go to a full 20 percent power uprate, what  
2 would be your main steamline velocity?

3 MR. DAVISON: I don't think we have that.  
4 We have not projected that out.

5 CHAIR ABDEL-KHALIK: Go to a microphone.

6 MR. BILANIN: Alan Bilanin from Continuum  
7 Dynamics Incorporated.

8 It's because it's a cost and pressure  
9 power uprate, power is a pressure times flow rate.  
10 Flow rate is velocity times cross sectional area.  
11 Five percent increase in power is a five percent  
12 increase in velocity in the main steamline.

13 CHAIR ABDEL-KHALIK: As long as the  
14 feedwater temperature remains unchanged.

15 MR. BILANIN: But that's minor change.

16 MR. DAVISON: Susquehanna also did a  
17 stretch uprate, so they changed their actual dome  
18 pressure as well.

19 CHAIR ABDEL-KHALIK: The point I'm trying  
20 to make is that if that is the case, it would be  
21 significantly higher than Susquehanna's main steamline  
22 velocity?

23 MR. DAVISON: Correct.

24 CHAIR ABDEL-KHALIK: Thank you.

25 MEMBER SIEBER: What was the actual one

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 that was for the amount of power increase that you  
2 decided to put into this amount, what was the limiting  
3 feature of the plant?

4 MR. DAVISON: The limiting feature is the  
5 high pressure turbine at this point. In fact, our high  
6 pressure, even the modified high pressure turbine will  
7 currently limit us to 111.5 percent power. We are  
8 going to need to assess further modifications to get  
9 to the license requested 115 percent power.

10 MEMBER SIEBER: Okay.

11 MR. DAVISON: In addition to that we have  
12 cooling tower. In summer operations we'd be cooling  
13 tower limited, so we'd also have to look into putting  
14 a helper tower or some other change that would allow  
15 us to lower our circ water temperature for our  
16 condenser.

17 MEMBER SIEBER: So those are pretty  
18 capital intensive --

19 MR. DAVISON: That is correct.

20 MEMBER SIEBER: Right. So that's why you  
21 chose to uprate as far as you did?

22 MR. DAVISON: Correct. Originally we  
23 started out at a 20 percent uprate and through the  
24 analysis phase of that back in the early 2000s got to  
25 115 because of that.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MEMBER SIEBER: That sounds reasonable.  
2 Thank you.

3 MR. DAVISON: You're welcome.

4 Page 13, Hope Creek utilized Continuum  
5 Dynamics Incorporated or CDI to perform the steam  
6 dryer analysis. This includes the Revision 4, the  
7 acoustic circuit model for the steam dryer load  
8 definition as well as the finite element analysis for  
9 modeling for the steam dryer stresses. This table  
10 represents the four lowest stress ratios for both the  
11 alternating and peak stresses. ASME code requires both  
12 alternating and peak loads to be evaluated.

13 Stress ratio here is defined as the  
14 allowable stress divided by actual stress, therefore  
15 the ratio with the lowest numerical value is the  
16 location with the lowest stress margin.

17 The alternating stresses are the most  
18 importance since they change with acoustic loads  
19 impacted by EPU and can lead to fatigue damage.

20 On this table are the four lowest of each  
21 of the alternating end peak. All other locations that  
22 were analyzed have a stress ratio about 2.5

23 The results of the steam dryer analysis  
24 performed at 115 percent show that lowest predicted  
25 alternating stress ratio is 2.8 with all the biases

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 and uncertainties included. This stress ratio located  
2 at the outer hood vane bank is predominately a result  
3 of flow induced vibration.

4 The lowest peak stress ratio is 1.58 at  
5 the skirt location. Peak stresses are related to the  
6 support of the structure's dead weight. And that peak  
7 stress is dominated by the actual dryer's weight,  
8 80,000 pounds, and shows negligible change at EPU.

9 The alternating stress ratio at this  
10 location is 9.36 in comparison to its peak and further  
11 supports the dryer dead weight is the dominating  
12 factor in the peak stress ratio location.

13 Hope Creek's stress values are shown at  
14 actual EPU conditions. All other locations have stress  
15 ratios greater than 2.5 as previously mentioned.

16 In past presentations at the ACRS  
17 Subcommittee by other utilities these ratios were  
18 discussed as a function of CLTP, therefore these  
19 stress ratios are well above allowable levels and  
20 consider margin at EPU. Of course, the assessment and  
21 how those numbers were derived will be covered in the  
22 closed session.

23 DR. WALLIS: Explain again<sup>f</sup> what shift  
24 means.

25 MR. DAVISON: Oh, thank you.

1           When we did all the analysis or CDI did  
2 all the analysis, to further look at that analysis they  
3 did a frequency shift at every point from between  
4 minus 10 and plus 10 and looked for what the worse  
5 value was, and that's the one we used.

6           So the shift that's listed there just  
7 happens to be the point --

8           DR. WALLIS: The frequency, that's the  
9 amount, the frequency shift to give the maximum --

10          MR. DAVISON: Correct. Correct.

11          DR. WALLIS: Okay.

12          MR. DAVISON: So in that plus to 10 and  
13 the minus 10 band we picked the highest one to  
14 represent that particular location.

15          Okay. The power ascension testing. From  
16 a monitoring perspective we talked a lot about this  
17 yesterday. In fact, why don't you put that slide back  
18 up. I think it'd be better if we talk to the slide we  
19 talked to yesterday, which we've updated.

20          What was on this slide is that we have  
21 strain gauges, accelerometers and we're going to be  
22 doing moisture carry over. A lot more testing will be  
23 done, as you'll see in the spreadsheet that we have  
24 for the non-dryer related analysis and monitoring  
25 during the power ascension phase.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           Each of the tests that we do, the strain  
2           gauges which -- excuse me. Strain gauges,  
3           accelerometers and moisture carry over all have two  
4           different levels of acceptance. Level two is -- below  
5           level 2 is just continue to do power ascension.  
6           There's nothing of concern. If we reach a level 2  
7           limit, that is a hold point. We have to stop and do  
8           analysis before we could continue power ascension.

9           If we hit a level 1 criteria, that would  
10          be stop, return the unit back to the previously  
11          acceptable power and then do analysis to determine  
12          what's next.

13          DR. WALLIS: Do you know how to predict  
14          moisture carry over when you change the change steam  
15          flow rate by 16.6 percent?

16          MR. DAVISON: Well, we've looked at other  
17          operating experience. Like Vermont Yankee I think  
18          increased by a factor of six. So we're bounding it  
19          with that.

20          DR. WALLIS: But it's empirical? You go  
21          from experience with other dryers? It's not as if you  
22          try to predict the carry over theoretically, is that  
23          true? It's all based on experience?

24          MR. DAVISON: Shelly?

25          MS. KUGLER: No. We actually do take

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 readings.

2 MR. DAVISON: No. Predict.

3 DR. WALLIS: Do you know how to predict  
4 it?

5 MS. KUGLER: Oh, no. We do not know how to  
6 predict.

7 This is Shelly Kugler.

8 No, we do not predict what it's going to  
9 be, we're not sure what it's going to be.

10 DR. WALLIS: But you have to have some  
11 idea what it's going to be, because then you have some  
12 idea if you've got something which is out of the  
13 ordinary which you didn't expect.

14 MR. DAVISON: Right.

15 DR. WALLIS: So you must have some  
16 prediction, but it's not a theoretical prediction.

17 MR. DAVISON: Yes.

18 DR. WALLIS: I think what you're telling  
19 me is it's a empirical prediction based on experience  
20 with other plants.

21 MS. KUGLER: Right.

22 MR. DAVISON: Right. GE analysis was  
23 done. They analyzed our current operating condition at  
24 .05 percent and the prediction at EPU would be .18  
25 percent. However, what we're also --

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 DR. WALLIS: So there's a lot more  
2 moisture carry over, like EPU?

3 MR. DAVISON: Well, the one difference is  
4 even though that's the predicted values, our actual  
5 operating and measured values is .005 percent.

6 DR. WALLIS: Is much less than predicted?

7 MR. DAVISON: Correct.

8 DR. WALLIS: So that's you're off by a  
9 factor of ten?

10 MR. DAVISON: That's correct. And then we  
11 bound that also with what we learned from the  
12 industry, Vermont Yankee being the factor of six that  
13 they went up.

14 DR. WALLIS: Yes. So you --

15 MR. DAVISON: All anticipated results  
16 expect to be below the .3 which we're designed to as  
17 the max limit.

18 DR. WALLIS: Yes. I'm just wondering, what  
19 you would call extraordinary. You get .005 now and  
20 when you go to EPU you expect something .006 or  
21 something, a slight increase maybe?

22 MR. LINDSAY: This is Paul Lindsay with  
23 Mainline Engineering.

24 The design numbers right now for moisture  
25 carry over for Hope Creek are .1 and have been

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 evaluated up to and including .3. Those two  
2 respectively are the level 2 --

3 DR. WALLIS: These are percent?

4 MR. LINDSAY: Percent, correct.

5 DR. WALLIS: Point one what?

6 MR. LINDSAY: Point 1 percent.

7 DR. WALLIS: Of what.

8 MR. DAVISON: Of moisture.

9 MR. LINDSAY: Moisture.

10 DR. WALLIS: By flow rate?

11 MR. LINDSAY: So the design numbers are .1  
12 and .3, however the operating experience, as Paul had  
13 mentioned, right now we are running .0058.

14 DR. WALLIS: Percent?

15 MR. LINDSAY: Percent.

16 DR. WALLIS: That's extraordinarily dry.

17 MR. LINDSAY: It is very dry at Hope  
18 Creek. And it's our expectation that we will not hit  
19 .1 percent during the power ascension.

20 DR. WALLIS: There's a huge change from  
21 .008 to .1? So how do you know what's unusual. Well,  
22 I'm just thinking. Suppose something breaks, you're  
23 looking for an unexpected increase in wetness.

24 MR. LINDSAY: That is correct. Part of our  
25 criteria is considering and looking for a 50 percent

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 step increase over previous measured values.

2 MEMBER BANERJEE: How do you measure  
3 moisture?

4 MR. LINDSAY: I'm not --

5 MR. DAVISON: We perform weekly tests of  
6 moisture carry over. And chemical does it through the  
7 analysis of sodium-24.

8 DR. WALLIS: So it's something dissolved  
9 in the water that you get?

10 MR. DAVISON: Correct. And we actually do  
11 that test weekly. We'll be doing it much more  
12 frequently during EPU.

13 DR. WALLIS: So you get .0058 percent now.  
14 So what do you expect to get when you get full EPU?  
15 And you talked about .1, which is so different from  
16 .0058.

17 MR. LINDSAY: Right.

18 DR. WALLIS: I would say something had  
19 broken.

20 MR. LINDSAY: Our expectation would be  
21 that we would be below .1 percent --

22 DR. WALLIS: But there's such a big band  
23 between .0058 and .1. It's not a very good symptom.

24 MR. LINDSAY: Again, as stated earlier,  
25 considering the Vermont Yankee experience where they

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 saw it behaved in a linear fashion and then once they  
2 achieved essentially 13 or 14 percent increase, they  
3 saw it moving up exponentially --

4 DR. WALLIS: That's because something  
5 broke? Is that because something broke?

6 MR. LINDSAY: No. That was under normal  
7 conditions.

8 DR. WALLIS: But there's a sudden increase  
9 anyway -- there's a sudden increase anyway without  
10 breaking anything just because of the design of the  
11 dryer. So how do you tell when your sudden increase is  
12 due to something breaking and when it's due to some  
13 phenomenon which just was there already?

14 MR. DAVISON: (1) we'll be doing the  
15 training so we'll be looking for changes, but it is a  
16 suite of things, of tests that we're going to be doing  
17 to monitor the dryer in addition to the strain gauges  
18 and accelerometer. So it's another way to trend and  
19 predict and monitor the dryer in addition to the  
20 strain gauge readings and the accelerometer on the  
21 main steamlines.

22 MEMBER ARMIJO: Is this moisture carry  
23 over a value that you currently measure typical of  
24 these dryers? That seems awfully good.

25 MR. LINDSAY: When you consider Vermont

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 Yankee started at .02, Hope Creek would be very good.

2 MR. PIERCE: I want to ask a question.  
3 I'm just curious about steam dryers and the technology  
4 for designing them. Is there any methodology for  
5 predicting when you design a steam dryer how much  
6 water it will take out of the steam, or is it just we  
7 hope for the best? Is there a science to it. That's  
8 a question I had. I don't know if you know the answer,  
9 it's just a rhetorical question. But I get the  
10 feeling there isn't.

11 MEMBER BONACA: It's not a rhetorical  
12 question. I think GE should try to answer that.

13 MR. DAVISON: Well, certainly there are  
14 design requirements for our piping and turbine systems  
15 that required the steam quality to be less than .3.  
16 So when it was originally designed. And I can only  
17 imply that there are criteria that they knew they had  
18 to meet so that we had a low enough steam or a  
19 moisture content to not impact or adversely impact our  
20 steam monitor or high pressure turbine.

21 MEMBER BONACA: I guess the issue is  
22 really how useful this moisture carry over is as a  
23 measure of the integrity of the dryer. It sounds like  
24 it's not particularly useful because you have really  
25 no theory to say what should be the baseline. So

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 sometimes it goes linearly, sometimes it goes  
2 exponentially. So what does it matter?

3 MEMBER MAYNARD: Yes, I would agree with  
4 that. Because you're dealing with such low numbers to  
5 start with that a change makes -- you're just in such  
6 a small range there. Although I think there's plenty  
7 of other ways to measure. And moisture carry over is  
8 important for other considerations.

9 MR. DAVISON: Right.

10 MEMBER MAYNARD: I'm not sure how valuable  
11 it is as a monitor of the integrity of the --

12 DR. WALLIS: Well, it would be valuable if  
13 you went to the EPU and you want it stepped up by a  
14 factor of two. And then the next day you jumped. Then  
15 you'd say, ah-ha, something new has happened. It would  
16 be good for that point of view.

17 MR. DAVISON: Right. You go search it for  
18 what has changed.

19 DR. WALLIS: It's not likely to break, and  
20 if it does break, it won't break instantly, will it as  
21 soon as you go to the EPU?

22 MR. DAVISON: We thought it was an  
23 important part of the testing suite for a couple of  
24 reasons.

25 (1) we had to verify just straight up that

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 we did not exceed the design requirements, that we  
2 needed to be less than .3 percent.

3 (2) is we want to see how the actual  
4 steam, the moisture carry over responds as we increase  
5 power so we have the data of going up in power. And  
6 then it also provides the baseline data for continued  
7 weekly tests as we do on a normal basis to detect a  
8 change once we get to EPU and --

9 DR. WALLIS: A good check would be to go  
10 back to the old power level and see if it went up at  
11 that power level. You have some base to judge by. If  
12 you suspected anything, you could go back to your old  
13 --

14 MEMBER BONACA: But it's so low, the whole  
15 power level.

16 DR. WALLIS: But probably they could  
17 measure it that well.

18 MEMBER MAYNARD: But I agree with Graham.  
19 I think the real value is not so much in as it's going  
20 up is do you see a step change after some steady state  
21 operation. And that would indicate that something has  
22 changed, whether it be in the dryer or something else.  
23 But I think that's a good valid --

24 CHAIR ABDEL-KHALIK: Now what again are  
25 the action levels corresponding to the moisture carry

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 over?

2 MR. DAVISON: I'll actually cover those on  
3 the slides. But for level 2 it's moisture carry over  
4 exceeding .1 or moisture carry over exceeding .1 and  
5 an increase by greater than 50 percent over the  
6 average three previous measurements.

7 DR. WALLIS: Ahhh.

8 MEMBER BONACA: So that takes into account  
9 your --

10 DR. WALLIS: So you have trouble getting  
11 to .1 by increasing by 50 percent over .0058 a few  
12 times.

13 MR. DAVISON: And to finish, the level one  
14 criteria is moisture carry over exceeding .3 percent.  
15 In that case we'd have to reduce back to power--

16 MEMBER SIEBER: Back to turbine flow?

17 MR. DAVISON: Correct.

18 MEMBER SIEBER: In fact, if you do have  
19 any concerns over the operation of the steam dryer you  
20 could still make these measurements because of your  
21 concerns that would happen to occur?

22 MR. DAVISON: Correct.

23 CHAIR ABDEL-KHALIK: Would it be helpful  
24 to tighten these action levels?

25 MR. DAVISON: The thing the fact that

1 we're starting off at such a low value and we're doing  
2 the hourly trend error -- the 2½ percent trending you  
3 see on the chart there these moisture carry overs done  
4 at every 1 percent power we'll be doing the analysis.  
5 I think the trend is valuable versus the absolute  
6 value.

7 The acceptance criteria itself is the  
8 no/go no when we do the analysis. Certainly if we see  
9 a trend that is surprising to us, we would be stopping  
10 and analyzing it regardless of what the absolute level  
11 2 or level 1 criteria is. Of course, level 1 criteria  
12 is the design limit of .3, so --

13 MEMBER SIEBER: I would imagine taking  
14 moisture measurements at those close intervals, that  
15 the noise and air band for the actual measurement  
16 would exceed what one percent of increase in power  
17 would come up with. So you really can't too much out  
18 of these moisture -- if they deviate to a pretty large  
19 extent or they deviate without some identifiable cause  
20 like the power increase. I think those are valid.

21 CHAIR ABDEL-KHALIK: What is the error  
22 band in this measurement?

23 MR. DAVISON: That I don't know. An  
24 analysis, we can get that from our chemistry  
25 personnel. The question is what is the percentage of

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 error or error band associated with --

2 CHAIR ABDEL-KHALIK: Right. I mean, is it  
3 a lot less than the 50 percent criterion that you're  
4 setting up for yourself.

5 MR. DAVISON: We'll provide that.

6 MEMBER BONACA: But moisture carry over is  
7 not the primary way of determining if something is  
8 happening.

9 MR. DAVISON: That is correct. That is  
10 correct. That's what the strain gauge and  
11 accelerometers are for.

12 The strain gauges for going back and  
13 looking at the loads on the dryer. The accelerometer  
14 is to see if there's some other phenomena happening to  
15 the piping system.

16 DR. WALLIS: So you measure moisture carry  
17 over by looking at the condensate and seeing how much  
18 of some chemical was transported all the way through  
19 the turbine --

20 MR. DAVISON: Correct.

21 DR. WALLIS: -- and the condenser, Okay.

22 MR. DAVISON: Condensate.

23 CHAIR ABDEL-KHALIK: Please continue.

24 MEMBER BONACA: But where is the sodium-24  
25 coming from here?

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MEMBER SIEBER: Where does it come from?

2 MEMBER BONACA: Yes. You're looking at  
3 sodium-24, right, you said?

4 MEMBER SIEBER: Injected probably around  
5 where the condensate --

6 MR. DAVISON: No, no. Naturally occurring  
7 this is not a tracer type test or injecting sodium-24.

8 MEMBER SIEBER: Right.

9 MR. DAVISON: Like you would do for a  
10 feedwater tank.

11 MEMBER BONACA: But where does it  
12 naturally occur or does it vary --

13 MEMBER SIEBER: In varies from location-  
14 to-location?

15 MEMBER BONACA: Yes. What is it associated  
16 with?

17 MR. DAVISON: We'll have to follow that  
18 up.

19 MEMBER BONACA: Yes. Well, if it's going  
20 to be some sort of a measure, however -- we need to  
21 understand a little bit about the errors and where  
22 it's coming from and what variability there could be.  
23 But presumably as it's an important measure, you want  
24 to have a good accurate measurement?

25 MR. DAVISON: Correct.

1 MEMBER BONACA: Okay.

2 MR. DAVISON: Most necessary and accurate  
3 for the turbine limitations as mentioned by we are  
4 using it as a predicting tool along with the other  
5 suite of assessments we'll be doing that are up here  
6 in the test matrix.

7 MEMBER SIEBER: You're doing it from a  
8 natural source, you have to take the ratio of what the  
9 raw water is versus what the condensation at the exit  
10 of the separator is.

11 MR. DAVISON: We'll have that as a follow  
12 up.

13 MEMBER BONACA: Thank you.

14 MR. DAVISON: You're welcome.

15 This is the chart that I spoke of  
16 yesterday. We did add it to show -- and the dark line  
17 at 111.5 and the CF, one is truncated there. The CF is  
18 with a correction factor applied for the cross flow  
19 system. That black line at 111.5 is where we'll be  
20 stopping with this cycle's testing. We just showed the  
21 continuation to a 115 percent to show what the testing  
22 would be when we pursued that. So the same suite of  
23 testing specifically around the dryer to see there's  
24 no changes.

25 MEMBER BONACA: Are you doing any tests

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 where you're closing off one of these four lines and  
2 increasing the velocity through the other lines to see  
3 what happens?

4 MR. DAVISON: No. We're not doing any  
5 abnormal alignment testing.

6 MEMBER BONACA: Is that information  
7 proprietary?

8 MR. DAVISON: No. The next slide I have--  
9 well, we'll show it in the closed session. But the  
10 next slide is --

11 DR. WALLIS: Well, just to repeat what we  
12 all know is that you're only monitoring the steam  
13 lines. You don't have any strain gauges in the dryer  
14 itself?

15 MR. DAVISON: That's correct. There's not  
16 a monitoring package installed on our dryer.

17 MEMBER BONACA: And these are  
18 accelerometers and strain gauges; you've got both of  
19 those?

20 MR. DAVISON: That's correct.

21 MEMBER BONACA: And the same locations or  
22 different locations?

23 MR. DAVISON: Same piping systems. The  
24 strain gauges were shown at the two locations. There  
25 are accelerometers throughout the main steamline.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. PIERCE: Is it impossible to put  
2 instrumentation inside the steam dome, or is that just  
3 something that's prohibited by the heat and  
4 environment?

5 MR. DAVISON: It is not impossible. In  
6 fact, new dryer installations require monitoring. In  
7 fact, Susquehanna will have a monitored dryer. Quad  
8 Cities had a monitored dryer. However, instrumenting  
9 an irradiated dryer becomes very dose intensive as  
10 well as cost prohibitive as well. But that is the  
11 primary reason why an irradiated dryer is not  
12 instruments. But it is physically possible.

13 MR. PIERCE: You say an irradiated dryer.  
14 You mean it's not protected from radiation or you  
15 mean--

16 MR. DAVISON: The fact that it's been in  
17 the vessel for 20 plus years.

18 MR. PIERCE: Oh, been in the vessel for a  
19 long time? Okay. All right.

20 MR. DAVISON: Yes. So even to work on it  
21 when we do inspections or if we were to have to do  
22 repairs when it's in the dryer pit out of the vessel,  
23 it still does --

24 DR. WALLIS: I would think if a dryer were  
25 shaking badly, it would actually ring the vessel.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 You'd detect something through the vessel itself if  
2 there -- I don't know how bad this thing shakes. But  
3 it's a pretty massive thing. And if it's actually  
4 shaking quite a bit, that metal is in contact with the  
5 vessel. It's supported by --

6 MR. DAVISON: The dryer itself isn't  
7 shaking. You know, we talked about the leveling that  
8 we did. And, of course, it's the plant --

9 DR. WALLIS: But a piece of it is shaking?

10 MR. DAVISON: You've got pieces of it.  
11 That the errors that we've seen in the industry are  
12 pieces of the dryer essentially peeling off, if you  
13 will, versus the whole 80,000 pound dryer itself.

14 DR. WALLIS: I know. But that piece  
15 shaking does get transmitted. So there's nothing  
16 detectable from outside when there's a problem with  
17 the dryer?

18 MR. DAVISON: Other than what we're  
19 monitoring, no. Specifically moisture carry over as  
20 well as the actual strain gauge data we'll be taking.

21 MEMBER MAYNARD: Do you have any loose  
22 parts monitoring system in the vessel?

23 MR. DAVISON: No, we do not.

24 CHAIR ABDEL-KHALIK: Okay. Is this the  
25 end of your open session presentation, Mr. Davison?

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. DAVISON: I can skip the next slide.  
2 Two slides up. All the next three slides were to show  
3 representation of -- the one that you're not seeing  
4 because it's proprietary, was just the PSD to  
5 frequency curve with a baseline where we're at and our  
6 level 1 and level 2 criteria where we would be  
7 predicting. That's how we're going to do that. We'll  
8 talk more about the actual analysis piece in the  
9 closed session. But it was literally just a curve. And  
10 that's how we will be communicating to operations  
11 information that will be provided to the NRC.

12 We have curves PSD versus frequency for  
13 each of the four steamlines. Every data point we take  
14 we'll be putting it on there to make sure we haven't  
15 exceeded a level 1 or level 2 criteria.

16 MEMBER BONACA: What is FIV?

17 MR. DAVISON: The next one that I can  
18 show, the flow induced vibration measuring, you see  
19 here this is just an example of one sheet of level 1  
20 criteria for the main steamlines and it also includes  
21 some of the feedwater lines in the drywell.

22 Where we have our accelerometers, what our  
23 current acceptance criteria values are and then how  
24 we'll be recording them and showing them as  
25 percentages. Eighty percent or less, good; exceed

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 that you're in a level 2 criteria, you exceed the  
2 level 1 criteria we're going to stop --

3 MEMBER BONACA: What is Xg, Yg, Zg and all  
4 these?

5 MR. DAVISON: That's just at the first  
6 location the main steam 26 inch pipe vertical rise  
7 elevation 154 in the drywell. IT has an X, a Y and a  
8 Z component.

9 MEMBER BONACA: So it's the measurement?

10 MR. DAVISON: Correct. You know  
11 acceleration in the X,Y and Z plane. And the g is that  
12 we're measuring it in gs.

13 And you can see some of the locations that  
14 when we worked with structural integrity did not  
15 require an accelerometer in that direction, piping  
16 configuration or support something else.

17 MEMBER BONACA: So .584 means .584 g?

18 MR. DAVISON: Correct. For that --

19 MEMBER BONACA: Acceleration?

20 MR. DAVISON: Correct. That location -- in  
21 the X direction at that location in the main  
22 steamline.

23 CHAIR ABDEL-KHALIK: Dr. Davison, rather  
24 than jumping back and forth between open and closed.  
25 In order to provide a coherent presentation, perhaps

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 you can include this in your closed session  
2 presentation?

3 MR. DAVISON: Yes, I can do that.

4 CHAIR ABDEL-KHALIK: Okay. At this time  
5 we'll hear from the staff, again in an open session.  
6 And then we'll have a closed session where both the  
7 applicant and the staff will make additional  
8 presentations on this material.

9 MR. DUKE: Mr. Chairman, could we get some  
10 clarification as to what information regarding the  
11 Susquehanna replacement dryer desired so that GE could  
12 look at whether that information is available and  
13 whether it can be shared with the Committee.

14 CHAIR ABDEL-KHALIK: You make specific  
15 changes to thicknesses --

16 MR. DUKE: Yes. There was a question as to  
17 how our dryer compares to the Susquehanna replacement  
18 dryer and GE's looking for a little more detail as to  
19 what type of information is being requested?

20 CHAIR ABDEL-KHALIK: The thicknesses of  
21 the plate that were changed from, for example, an  
22 eighth of an inch to a half of inch, were these the  
23 same changes that were made in the Susquehanna dryer.

24 MR. DUKE: Thank you.

25 CHAIR ABDEL-KHALIK: Please refer to the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 nonproprietary staff presentation at this time.

2 Proceed.

3 MR. MANOLY: Good morning. I'm Kamal  
4 Manoly the Advanced Chief of the Chemical and -- with  
5 the Division of Engineering, NRR. And I'm presenting  
6 first the team of the staff and the contractors who  
7 supported us in the reviews of the Hope Creek dryer  
8 and other mechanical components.

9 The review started with Tom Scarbrough and  
10 Dr. John Wu. And John and Tom moved to NRO, but  
11 they're still supporting us. Currently we have Dr.  
12 Chakrapani that's on my staff and also supported by  
13 three contractors, Argonne National Lab Dr. Vikram  
14 Shah and Dr. Ziada is the other and Dr. Steve Hambric  
15 from Penn State.

16 I guess we'll start with the amount of  
17 gradation of the application.

18 Tom Scarbrough will go through the  
19 nondryer portion first. And then we'll follow that  
20 with the dryer portion.

21 MR. SCARBROUGH: Good morning. I'm Tom  
22 Scarbrough.

23 Just again to give you an overview of our  
24 evaluation areas --

25 MEMBER BONACA: Tom, where are you now?

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 You have moved?

2 MR. SCARBROUGH: Yes. I'm in the Office of  
3 New Reactors now.

4 MEMBER BONACA: I see. Did SSES drive you  
5 out of this or what?

6 MR. SCARBROUGH: No. Actually, it's one of  
7 the more enjoyable engineering areas --

8 MR. LAMB: We tried to keep him.

9 MR. SCARBROUGH: So these are the areas  
10 that we reviewed, the pipe rupture locations and  
11 dynamic effect, pressure-retaining components and  
12 supports, the nuclear steam supply system, piping  
13 components and supports, balance of plant, reactor  
14 vessel and supports, control rod drive mechanism,  
15 recirculation pumps and supports, reactor pressure  
16 vessel internals and core supports, safety-related  
17 valves and pumps, seismic and dynamic qualification of  
18 equipment and potential adverse flow effects which  
19 we'll talk a bit about this morning.

20 So those are the broad areas that we look  
21 at.

22 In terms of the scope of the review, we  
23 look at the methodology applied and the loads that  
24 will result from the constant pressure power uprate,  
25 the resulting stresses and cumulative fatigue usage

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS,  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 factors, the acceptance criteria, the applicable code  
2 editions and addenda, and the impact on functionality  
3 of safety-related pumps and valves and the piping over  
4 pressurization analysis for the proposed EPU.

5 We also look at the acoustic and flow-  
6 induced vibration loading and monitoring to provide  
7 confidence of the structural integrity of the plant  
8 components.

9 DR. WALLIS: Did you do any confirmatory  
10 analysis?

11 MR. SCARBROUGH: No.

12 DR. WALLIS: Did you do any for the other  
13 plants with EPUs?

14 MR. SCARBROUGH: No, we didn't.

15 MR. MANOLY: At Vermont and Susquehanna.  
16 And the work on Quads was really after the license was  
17 granted. So we're really following the operational  
18 failures and then the fixes that took place after  
19 that. But in all of that we did not do confirmatory  
20 analysis.

21 We reviewed the licensee's work in great  
22 detail, and that's why we're using the Argonne and the  
23 professors from Penn State and McMaster for that  
24 purpose.

25 MEMBER BONACA: Maybe I shouldn't say this

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 is an open session, but did you discover some errors  
2 in the previous analyses?

3 MR. MANOLY: What do you mean by  
4 "previous"? Which ones?

5 MEMBER BONACA: Of any of the other  
6 plants?

7 MR. MANOLY: Well, you know, engineering  
8 is -- people who have done design sometimes disagree  
9 on certain parameters. But I wouldn't call that  
10 errors in the sense that something was missed  
11 completely. But sometimes we disagree on certain  
12 parameters and we discuss it with the applicant and we  
13 reach an agreement.

14 MEMBER BONACA: How large were these  
15 disagreements?

16 MR. MANOLY: It depends on the variables.  
17 I mean, there are a lot of the -- as you go through  
18 the slides in the SE, there was a lot of -- these  
19 parameters were discussed and negotiated. And it's a  
20 new area that we're getting into that was not  
21 something that didn't -- you know, looked at the past  
22 and like other structures which the science or the  
23 state-of-the-art is pretty much stabilized.

24 MEMBER BONACA: Okay. We need to follow  
25 this up. I want to understand clearly what you found

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 in the past in terms of problems.

2 MR. MANOLY: Okay.

3 MR. SCARBROUGH: This is still an  
4 overview. Coolant pressure boundary and balance-of-  
5 plant piping systems were evaluated for EPU.

6 The main steam and feedwater piping and  
7 supports were evaluated because of the higher loads  
8 and flows, the 24 percent or so increase in flow rates  
9 for main steam and feedwater, which increased some of  
10 the break flow rates. And there was evaluation of the  
11 loads was looking for that.

12 Other piping would be less affected by the  
13 EPU conditions.

14 The results that were calculated where the  
15 stresses were less than the applicable ASME Section  
16 III and the ANSI B31.1 code allowable rates.

17 MR. PIERCE: You say you calculated  
18 stress. What was the conditions by which you  
19 calculated? Did you do your calculations or you  
20 reporting on your assessment calculations done by the  
21 USSIE.

22 MR. SCARBROUGH: The licensing did the  
23 calculations and then we review the calculations and  
24 look for changes for how they did the calculations.

25 MR. PIERCE: Okay. So it was not clear

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 from the statement as to who did the calculations.  
2 Okay. Thank you.

3 MEMBER BONACA: But the stresses, of  
4 course, depend very much on the loads. And so we have  
5 to discuss how these loads were calculated.

6 MR. MANOLY: Yes.

7 MEMBER BONACA: But there are two parts of  
8 this. One is the loads and the second part, of course,  
9 is the finite element analysis. Both are subject to  
10 some level of scrutiny. And if you'll go into details  
11 of how these loads were --

12 DR. SHAH: We will do that in the  
13 proprietary portion of presentation.

14 MEMBER BONACA: And why we should believe  
15 these loads?

16 DR. SHAH: Yes. We did quite a --

17 MEMBER BONACA: Okay.

18 MR. MANOLY: Tom's still discussing the  
19 nondryer portion here.

20 MEMBER BONACA: Oh, okay. All right. WE  
21 see the top. Okay.

22 MR. MANOLY: This is partly the analysis  
23 where the exceed limits are being evaluated.

24 MEMBER BONACA: Okay. You are going to  
25 come to the dryer?

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. SCARBROUGH: Yes, we are. We are just  
2 giving the other areas that we reviewed first.

3 In terms of the evaluation of the safety-  
4 related pumps and valves, we looked at the pumps and  
5 valves that was within the scope of ASME code. We  
6 focused on the EPU affects for the functional  
7 performance of the pumps and valves and acceptance  
8 criteria related to the general design criteria and  
9 50.55(a). And how we did this we looked at the review  
10 of what was changing from the EPU conditions, how  
11 would that effect the pumps and valves. We asked for  
12 examples to look and see how they addressed Generic  
13 Letter 8910, NOV promoted off the valve program and  
14 any changes to those types of programs and what  
15 parameters were being adjusted as a result of the EPU.

16 So we did that review and we found roughly  
17 minor changes to the parameters that would affect this  
18 equipment. So we didn't have any concerns with the  
19 pumps and valves area, which was my area of the  
20 review.

21 And now we're getting to the potential  
22 adverse flow effects.

23 And the areas that we're going to talk  
24 about are: The steam dryer function; the dryer  
25 modifications; the dryer review. And those two

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 specific areas we'll be talking about in detail during  
2 the closed session. And then the monitoring and the  
3 power ascension test plan and the license conditions.  
4 So we'll cover those in this open session.

5 MEMBER BONACA: But isn't the monitoring  
6 and power ascension going to depend somewhat on the  
7 stuff in the closed sessions?

8 MR. SCARBROUGH: Right, there will be.  
9 But in terms of the license conditions, that's open.

10 MEMBER BONACA: Yes, of course.

11 MR. SCARBROUGH: We can talk about that in  
12 open.

13 MEMBER BONACA: All right. But the reasons  
14 behind the license conditions we revisit that?

15 MR. SCARBROUGH: Yes.

16 MEMBER BONACA: Okay.

17 CHAIR ABDEL-KHALIK: We will revisit the  
18 plant monitoring --

19 MEMBER BONACA: Right.

20 CHAIR ABDEL-KHALIK: -- and  
21 instrumentation, et cetera later on --

22 MEMBER BONACA: And the power ascension?

23 CHAIR ABDEL-KHALIK: -- after in addition  
24 to whatever you'll present in the open session. We  
25 will revisit that later on, after lunch, perhaps?

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. SCARBROUGH: Sure. Absolutely.

2 In terms of the steam dryer function  
3 itself, it's function is to remove moisture from the  
4 steam prior to exiting the reactor pressure vessel  
5 moving into the main steam lines and then to the  
6 turbine generator. That's where those limits that you  
7 were talking about a few minutes ago came from.

8 There's no specific safety function for  
9 the dryer. Its function is to remove that moisture,  
10 but it must retain its structural integrity to avoid  
11 a generation of loose parts that might adversely  
12 impact the capability to other equipment to perform  
13 their safety functions. So we're focused here in our  
14 review as part of the structural integrity.

15 MR. MANOLY: I would just add that in  
16 terms of structural integrity, it could potentially  
17 have cracks but it doesn't result in loose parts,  
18 they're okay. It's really the point here is that you  
19 try to avoid the generation of loose parts. It's a  
20 different threshold then you would expect for other  
21 structures. That's what I would like to highlight.

22 DR. WALLIS: But this no safety function  
23 always puzzles me. I mean, it's obviously not designed  
24 in order to improve safety. But in the event of a pipe  
25 break in which there is flow through the steam dryer,

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 it's going to effect what happens. So even if it's  
2 not designed to have a safety function, what happens  
3 in an event is going to be -- it's like an automobile.  
4 I mean, there are breaks and air bags and all kinds of  
5 things. But there are other things which don't have  
6 any obvious safety function which will affect what  
7 happens in an accident. And somehow or other because  
8 they're not specifically designed with a safety  
9 function, they're said to be unimportant.

10 MR. MANOLY: Most of the discussion here  
11 really is focusing on the operational loads. Now that  
12 also designs for main steamline break. But the design  
13 loading is not as destructive as operational load. So  
14 they're full --

15 DR. WALLIS: I'm just saying the idea that  
16 it has no safety function doesn't mean to say that it  
17 doesn't have any influence on what happens during an  
18 accident. That's just what bothers me, that you sort  
19 of dismiss it as having no safety function so we don't  
20 need to think about it in terms of safety.

21 There can be accidents where it might have  
22 some influence on what happens. That's the only thing  
23 that troubles me.

24 MR. MANOLY: Well, as long as it does not  
25 break into pieces that would get hammed in MSIVs --

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 DR. WALLIS: There's no way it can  
2 influence the course of accident?

3 MR. MANOLY: I don't believe so. But  
4 someone may question that. But I don't believe --  
5 because you're designing to the main steamline break.  
6 That's the design basis for the dryer. But that's not  
7 the governing load in terms of dryer failure is --

8 DR. WALLIS: The main steamline break,  
9 presumably, anything coming out of the core has to go  
10 to the steam dryer to get to the steamline. So it's  
11 going to have some affect on what happens.

12 MEMBER BANERJEE: But it can retain its  
13 structural configuration.

14 DR. WALLIS: Except during the accident,  
15 right?

16 MEMBER BONACA: Are the loads much lower  
17 than during normal operation?

18 MR. MANOLY: Because you have just to one  
19 type loading, whereas during operation you have that  
20 cycling that's going on.

21 MEMBER BONACA: Well, imagine that --  
22 well, I don't say imagine. But imagine that the dryer  
23 was cracked and then you quite a high load which  
24 wasn't a vibrational load, but it could lead to  
25 vibrations as well because of vortex shedding or

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 whatever and the dryer fell apart at that point. Is  
2 there a safety concern associated with that?

3 MR. MANOLY: There probably would be, yes.  
4 I mean, if it's cracked in a way that degraded the  
5 cross section so much -- yes, I would agree with you.

6 MEMBER BONACA: Or some part broke off or  
7 something.

8 MR. PIERCE: Can I ask a question? Has  
9 the present steam dryer, have you ever taken the thing  
10 apart and looked at it to see if it had any cracks or  
11 has it never been examined for cracks so far?

12 MR. MANOLY: Well, I think in the  
13 presentation they modified dryer.

14 MR. SCARBROUGH: And they had to form  
15 baseline inspections following the BWR --

16 MR. PIERCE: It does include a modified or  
17 they're about to modify it?

18 MEMBER BONACA: They modified 20 years  
19 ago.

20 MR. SCARBROUGH: Before they even started  
21 the plant up. Before they started the plant up the  
22 very first time 20 years ago they put in these  
23 modifications to strengthen its structural integrity.

24 MR. PIERCE: But since it's been running  
25 all these years, have they actually pulled it apart

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 and looked and it to see if there are any cracks?

2 MR. SCARBROUGH: No. They perform  
3 inspections on it per the BWR Owners' Group guidance  
4 in the past.

5 MR. PIERCE: But that's external?

6 DR. SHAH: They took it out.

7 MR. PIERCE: Oh, they did take it out?  
8 Okay.

9 DR. SHAH: During the refueling. And then  
10 they can inspect it.

11 MR. PIERCE: Because when I read a  
12 newspaper, I read for instance in Vermont the results  
13 are the stuff about cracks in the Vermont Yankee.

14 DR. SHAH: You're right. That's correct.  
15 Vermont has some IGSC cracks.

16 MR. PIERCE: Yes. Yes.

17 DR. SHAH: But after the first cycle of  
18 operation. And they didn't believe that it has nothing  
19 to do with fatigue cracking.

20 MR. PIERCE: Right.

21 DR. SHAH: And they left them in place.  
22 Now they will examine them again in next outage to see  
23 if there is any increase.

24 MR. SCARBROUGH: And those conditions that  
25 we proposed for Hope Creek as well where they do those

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 inspections --

2 MR. PIERCE: Yes. Right.

3 MR. SCARBROUGH: -- for several outages to  
4 look for any --

5 MEMBER BONACA: Now these are visual  
6 inspections, of course, right?

7 MR. MANOLY: Yes, yes.

8 MEMBER BONACA: And can they see all the  
9 important parts of this dryer with these visual  
10 inspections.

11 MR. SCARBROUGH: The ones that are  
12 available from their inspection from looking at the  
13 outside. There's guidance in the BWRVIP-139 document  
14 which gives them guidance on where to look for welds  
15 that may show cracks on that outer hood, which is the  
16 place where we have the most interest because that's  
17 where the loose parts would really come from. So they  
18 look at that very closely in terms of looking at the  
19 welds and seeing to look for any cracks that might  
20 appear in that. So that's they have --

21 DR. WALLIS: Can I go back to my point?

22 I'm told we have about mach .1 in a  
23 steamline, right? Mach .1 is what I'm told. I think  
24 I read.

25 MEMBER BANERJEE: No. It's 160 feet per

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

(202) 234-4433

www.nealgross.com

1 second.

2 DR. WALLIS: I was told Mach -- it's Mach  
3 .10 something or other.

4 MEMBER BONACA: Three hundred meters per  
5 second is --

6 DR. WALLIS: So it's .1 Mach. Now the  
7 streamline breaks, right, you could choke flow in the  
8 streamline, presumably, at Mach 1. So you've got ten  
9 times the velocity. Doesn't that do something to the  
10 dryer?

11 MR. SCARBROUGH: Those are analyzed. The  
12 loads -- those loads are analyzed as part of --

13 DR. WALLIS: So the dryer draws okay with  
14 that sort of sudden increase in velocity?

15 MR. SCARBROUGH: Right. Those are  
16 analyzed--

17 DR. WALLIS: The load must increase by an  
18 enormous amount of what it does, the normal operation.  
19 Again, that's analyzed?

20 MR. SCARBROUGH: That's analyzed.

21 MEMBER BONACA: Does load go as the linear  
22 part of the velocity or the square of the velocity?

23 DR. SHAH: Square velocity.

24 MEMBER BONACA: You go with the square,  
25 the speed of sound roughly is, let's say, a factor of

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 five. So you've got a load which is a factor of 25  
2 more.

3 DR. WALLIS: Yes, it's bigger than that.

4 MEMBER BONACA: Or maybe it's a factor of  
5 ten. I don't know, whatever.

6 MEMBER SIEBER: The question is did the  
7 applicant or the staff make a calculation at main  
8 steamline break flows to determine if the dryer would  
9 fail. Now if you would tell yes or no, I think that  
10 would --

11 MR. MANOLY: The dryer is evaluated for  
12 the main steamline break. All dryers are. Actually,  
13 that's what we looked at at Quad Cities and focused on  
14 and then realized that that was not the governing  
15 load.

16 DR. WALLIS: Thank you. That's good.

17 MEMBER SIEBER: And the dryer has to  
18 withstand that until the main steam isolation valves  
19 close, right.

20 MEMBER BONACA: I guess the issue is if it  
21 has been tracked previously whether it would break up.  
22 Because the intact valve, presumably, holds up to the  
23 loads that you're talking about. But then if there are  
24 fatigue cracks, what happens at that point?

25 MR. SCARBROUGH: Well, that's part of

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 evaluating to make sure that the loads for these  
2 increasing resonance potential is less than the  
3 fatigue cracking limit. So that's part of the  
4 evaluation to make sure it's below that. So that's  
5 our goal.

6 MR. MANOLY: With margin.

7 MR. SCARBROUGH: With margin.

8 DR. WALLIS: Right.

9 MR. HYLAND: My name is Pat Hyland. I'm  
10 the Director of Engineering in NRR.

11 And I just want to clarify the question,  
12 if I could, or at least our answer to it.

13 Clearly the dryer has a safety function,  
14 just as the staircase I walk up every day has a safety  
15 function not to fall.

16 You're correct that just a flat statement  
17 no safety function is misleading. What that means is  
18 no safety function as applied under the Appendix B 10  
19 CFT quality assurance 18 criteria.

20 There's no credit, I believe, taken for  
21 the dryer as far as the analysis is to the pipe  
22 failure what happens to the public, what's released.  
23 You can calculate credit for scrubbing, but there's no  
24 credit taken in the analysis.

25 Clearly it's important. Every piece of

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 equipment in the plant is equipment important,  
2 especially those staircases I walk up. So it is  
3 important to safety.

4 DR. WALLIS: Thank you.

5 MR. SCARBROUGH: Okay. In terms of the  
6 steam dryer modifications, you've heard some about  
7 them a few minutes ago. But it is curved hood design.  
8 They did perform modifications and we have a slide for  
9 that for the closed session. And there's been no  
10 significant performance issues for the dryer for the  
11 20 years of operation that its seen.

12 The broad picture of the steam dryer  
13 review and findings. The contract assistance that  
14 we've mentioned, we evaluated the steam dryer analysis  
15 through numerous information requests and meetings.

16 There was an audit of this team at the CDI  
17 office in May of last year.

18 The conclusion is that there is reasonable  
19 assurance that the Hope Creek steam dryer is within  
20 structural limits for current license thermal power  
21 and up to the extrapolated EPU conditions. And we  
22 consider the dryer analysis to be acceptable for EPU.

23 And this is just an overview of what we'll  
24 talk about in details.

25 MR. PIERCE: Can I ask you what does

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 "audit" mean?

2 MR. SCARBROUGH: Oh. This team went to  
3 the CDI office in New Jersey.

4 MR. PIERCE: Yes.

5 MR. SCARBROUGH: And reviewed their  
6 analyses and had discussions with their contractors in  
7 detail of their evaluation of the dryer and observed  
8 their scale model testing facility, discussed that  
9 operation with them. And so that's the type of quality  
10 that where we actually go to either the plant itself  
11 or a contractor office and look through the  
12 calculations and information or detail.

13 MEMBER BONACA: And these calculations are  
14 often done with things like computer codes and so on?

15 MR. SCARBROUGH: Right.

16 MEMBER BONACA: So do you also audit the  
17 computer codes?

18 MR. SCARBROUGH: There was discussions  
19 with the gentleman who ran the computer codes there,  
20 members of the team reviewed with that and observed  
21 how they set up their computer mathematical analysis  
22 and discussed that with them. So that was part of the  
23 audit as well.

24 MEMBER BONACA: And so there was some sort  
25 of due diligence done about these codes?

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. SCARBROUGH: Yes.

2 MR. MANOLY: Yes.

3 MEMBER BONACA: And the models in them?

4 DR. SHAH: We reviewed the models.

5 MEMBER BONACA: And the applicability.

6 But are these approved codes or what are they?

7 MR. SCARBROUGH: No. They're codes that  
8 are specific to the CDI contractor. So they're  
9 specific. They aren't codes that have been submitted  
10 as a topical code, a topical report code that we've  
11 done reviews for. These are plant specific codes where  
12 an individual utility will use them. And we use them  
13 or I weight them for the plant-specific basis. They  
14 aren't like generically approved codes.

15 DR. SHAH: I think for analysis they use  
16 the AXIS code --

17 MEMBER BONACA: But AXIS is not been  
18 approved, has it? It's accepted.

19 MR. MANOLY: When you say "approved," the  
20 NRC we go to the approved -- we do some confirmatory  
21 comparisons and benchmarking. And AXIS is being widely  
22 used to compare to other codes. And we don't --

23 MEMBER BONACA: Well, this is a rather  
24 larger issue --

25 MR. MANOLY: Yes.

1                   MEMBER BONACA:    -- which I don't need to  
2                   take up here.  But there is an issue of using  
3                   commercial codes in this way without actually having  
4                   the source code and looking at it carefully and being  
5                   sure.

6                   I mean, the other stuff is pretty  
7                   circumstantial.  So if you use a CFD code like FLUENT  
8                   or something, for indicative purposes it's okay.  But  
9                   you haven't actually delved into the code in the same  
10                  detail as when you approved a code such as submitted  
11                  by a vendor or something where you go into it great  
12                  detail for that.

13                  MR. MANOLY:  Yes.  There are two codes here  
14                  that I guess Tom was referring to.  Once is the  
15                  acoustic circuit model analysis code, and that's a  
16                  proprietary code that CDI had developed.  And the other  
17                  one is after the loads are developed it is applied on  
18                  the dryer, they use ANSIS.  And we are much more  
19                  knowledgeable about ANIS than the acoustic circuit  
20                  model code, which we have looked at --

21                  MEMBER BONACA:  But there is an issue of  
22                  transparency related to some of these codes like ANSI  
23                  or FLUENT or whatever.  And these codes are not  
24                  available in source code, at least I don't know if  
25                  ANSI is to you, but some of the other codes are not.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 And they're being used based on sort of circumstantial  
2 evidence that they work in chemical applications or  
3 something where our standards of looking into them are  
4 much different from what is required for a nuclear  
5 plant, you know, in terms of the validation of the  
6 result of quality assurance about the results.

7 MR. MANOLY: I believe that we had looked  
8 at benchmarking of various codes. And sometimes we  
9 reviewed Brookhaven National Lab to benchmark some  
10 codes that are coming up recently. But I don't believe  
11 we have a problem with ANSIS. I mean I've never --  
12 I've been with this branch for a long time, and there  
13 was never an issue that came that the results using  
14 different codes have invalidated the answers.

15 Now misapplication of the codes can give  
16 you erroneous results, and we all know that. I mean,  
17 when you're doing time history analysis you can get  
18 any answers you want depending on the steps, you know,  
19 delay. But whether the code has flaws in it, that's  
20 a different --

21 MEMBER BONACA: All these codes have flaws  
22 in them.

23 CHAIR ABDEL-KHALIK: Let's continue with  
24 the presentation, please.

25 DR. WALLIS: Well, I was wondering if we

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 couldn't follow this up a little bit just to be clear  
2 to the public. I mean this audit, you looked at -- the  
3 ANSIS code is part of it, right, if you looked at it?  
4 You accept that as for the mechanical part. But  
5 there's CDI analysis, which is particular to this  
6 plant, it's not part of some standard procedure which  
7 is a code. And so you have to accept. And it's been  
8 said it's an open session. Your audit has to satisfy  
9 you that what CDI developed is a special analysis for  
10 this plant was adequate?

11 MR. SCARBROUGH: Right. And we can talk  
12 about that in the closed session.

13 DR. WALLIS: When you put it in this open  
14 session as an audit, it wasn't as if you were just  
15 looking at the use of a standard code. You were  
16 looking at a specific analysis for this plant?

17 MR. SCARBROUGH: Exactly. Yes, sir.

18 MR. PIERCE: Can I make one comment or  
19 question?

20 In your request for additional information  
21 I know at least on one occasion you asked the licensee  
22 to increase or to reduce the mesh size or refine the  
23 mesh.

24 MR. SCARBROUGH: Yes.

25 MR. PIERCE: And apparently you do worry

1 about such things when you do your analysis or things  
2 that you're wondering whether or not they have used  
3 ANSIS correctly.

4 DR. SHAH: We have done, at least the  
5 things we'll talk in the closed -- proprietary  
6 session. We have underscored them more than that.

7 MR. PIERCE: Yes.

8 MR. SCARBROUGH: Moving on to the plant  
9 monitoring part, you know the licensee evaluated what  
10 systems would be potentially susceptible in the  
11 installed accelerometers and such in places where  
12 those systems could be susceptible. There's  
13 acceptance criteria that's part of the power ascension  
14 program. They're using the ASME standard in Guide Part  
15 3 for the methodology for vibration.

16 They did install vibration accelerometers  
17 back in 2004 and gathered baseline data to look for  
18 any potential resonances, and did not see any.

19 As part of the monitoring they will be  
20 performing visual walkdowns.

21 And as I mentioned, they did install  
22 accelerometers on the safety relief valve pilot valve  
23 assemblies to look for potential vibration for those  
24 components.

25 And they performed some modifications to

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 reduce the susceptibility to piping vibration as part  
2 of that.

3 DR. WALLIS: Could you tell me, we saw --  
4 are we going to talk about that page we saw which was  
5 flashed up there with the acceptance criteria, or  
6 we're not allowed to talk about that? Can we talk  
7 about that?

8 I think I saw things like half a g or  
9 something up there, maybe 1 g. An order of magnitude  
10 of a g. Could you give me some idea of what a pipe is  
11 like when it's oscillating with 1 g? Is it like a  
12 washing machine shaking or is it like a train going  
13 by, or is like a thunderstorm? Or what is it like when  
14 a big pipe oscillates at 1 g?

15 MR. MANOLY: It's oscillation for size --

16 DR. WALLIS: Yes, what's it like? If  
17 you're standing there and a steam pipe is oscillating  
18 with 1 g? What's it like? Is the world shaking if  
19 you're near it, or is it just a slight vibration?  
20 What's it like?

21 MR. MANOLY: Well, it depends on how's it  
22 supported. I mean, if you have --

23 DR. WALLIS: Tell me how it's supported.

24 MR. MANOLY: If you have large spans, it  
25 is different than if you have very short spans.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 DR. WALLIS: So there's no way you can put  
2 it into human terms that I can understand?

3 MR. MANOLY: Well, I mean big -- if the  
4 spans are very large. For service water piping where  
5 it's the nonsafety part when you have huge piping with  
6 -- but you don't see really 1 g at the service water  
7 piping. So --

8 DR. WALLIS: But you can't put it in some  
9 way which I can visualize? I mean, I have no idea  
10 what 1 g is like when a pipe shakes.

11 MEMBER BONACA: Is it like a small  
12 earthquake, a large earthquake, or a medium size  
13 earthquake?

14 DR. WALLIS: What is it?

15 DR, HAMBRIC: This is Steve Hambric from  
16 Penn State.

17 It all depends on the frequency of the  
18 vibration.

19 DR. WALLIS: Okay. Well, we know what the  
20 frequencies are in this case.

21 DR, HAMBRIC: Well, it depends.

22 MEMBER BONACA: You have 15 Hertz or 160  
23 Hertz we've been told in rough terms.

24 DR, HAMBRIC: So divide by  $2\pi$  15 squared  
25 and that give you one displacement. Divide by  $2\pi$

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 150 square, it'll give you much smaller displacement.

2 MEMBER BONACA: Well, let's take the 15.

3 DR, HAMBRIC: Okay. I'm trying to do the  
4 math in my head. You're talking about roughly a 1,000  
5 -- 9.81 meters per second squared divided by 1,000. So  
6 -- well, it's not huge. It's small. You're not doing  
7 this.

8 DR. WALLIS: Okay. So it's a very large  
9 vibration. And so visually if I were there, I would  
10 know that it was oscillating?

11 DR, HAMBRIC: Right. But you wouldn't be  
12 backing away.

13 DR. WALLIS: I wouldn't be backing away.  
14 Okay.

15 MR. MANOLY: Safety-related piping in the  
16 plant usually between 10 or 15 Hertz.

17 DR. WALLIS: That's helpful.

18 MR. MANOLY: That's typical.

19 MEMBER SIEBER: Compared to everything  
20 else in the plant, you probably wouldn't --

21 DR. WALLIS: Right. All the other noises  
22 going on, you wouldn't notice?

23 MEMBER SIEBER: That's right.

24 MEMBER BONACA: Now the question arises  
25 how good of indicator is this of what's going on the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 dryer then?

2 CHAIR ABDEL-KHALIK: We'll get to that.

3 DR, HAMBRIC: Well the acceleration to  
4 measure the strains or measure the strains around the  
5 group of the --

6 MEMBER BONACA: We realize that, but the  
7 accelerometers are also used as backup we are told.  
8 We're also measuring the accelerations.

9 MR. SCARBROUGH: Right, that's one of the  
10 plant monitoring --

11 MEMBER BONACA: We're just asking.

12 MR. MANOLY: For monitoring also for  
13 piping, we use the OM standard for displacement,  
14 amplitudes. I guess the question is for piping or for  
15 other components. You know, you have the OM standard,  
16 that's the industry standard for verification of the  
17 amplitudes that you don't exceed the OM limits.

18 CHAIR ABDEL-KHALIK: Okay.

19 MR. SCARBROUGH: If we move to the power  
20 ascension test plan. The established criteria, as you  
21 heard this morning there's two levels. There's the  
22 level 1, which is a power reduction, if they hit that  
23 level. And then a level 2 which is a power hold. And  
24 we'll have some more details on that during the closed  
25 session.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           There's EPU startup test procedure and  
2           there's a license division which goes through the  
3           contents of that test procedure in terms of the limit  
4           curves, the hold points, the parameters, the  
5           inspections and walkdowns and actions that you take.

6           And if you have acoustic signals that  
7           challenge those limit curves, there's methodologies  
8           for updating the limit curves themselves. And the  
9           test plan will include detail monitoring analysis.

10           And then over the longer term there's  
11           steam dryer inspection requirements. And those will  
12           follow the BWRVIP-139 document.

13           MEMBER BONACA: Are you going to deal with  
14           this in more detail, Tom, when it comes to the closed  
15           session or --

16           MR. SCARBROUGH: Well, actually, I have  
17           some information here which will kind of go through  
18           most of the license conditions which kind of lays out  
19           what the power ascension test plan is.

20           MEMBER BONACA: The broad question I have  
21           before you even get into this is when we had plants,  
22           we've had similar curved hood designs and so on, with  
23           lower velocities and instrumented dryers. We wanted  
24           to have a power ascension plan which actually closed  
25           off things like one of the steam lines in order to get

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 power velocities in the other lines. And we had a  
2 very, very systematic way of raising power very slowly  
3 using that as a pilot. Okay. And we were trying to  
4 relate what was happening in the dryer to what was  
5 happening in the lines, and so on. And we had that  
6 sort of measurement.

7 And on that basis we approved the power  
8 ascensions plans and so.

9 Now with this dryer, which is not  
10 instrumented which is an old dryer which maybe have a  
11 curved hood which has higher velocities, we are not  
12 putting this type of power ascension plan together  
13 where we monitor what's going on in three lines rather  
14 than by closing the fourth so we have that effect of  
15 the higher velocity in advance of actually doing it.  
16 So you are going to explain the rationale while why we  
17 do this for one of our plants and why we don't --  
18 which is better instrumented with a new dryer and  
19 we're not going to do it for this?

20 MR. SCARBROUGH: Right. We probably should  
21 talk about that in the closed session.

22 MEMBER BONACA: Okay.

23 MR. SCARBROUGH: Because we do have  
24 information that we can talk about that.

25 MEMBER BONACA: All right.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. SCARBROUGH: Yes. When you see the  
2 power ascension test plan through the license  
3 condition, there's not that closure of an MSIV that's  
4 shift of steam.

5 MEMBER BONACA: Right.

6 MR. SCARBROUGH: That's not part of it.  
7 So --

8 MEMBER BONACA: No. This is a very  
9 different power ascension plan than we've approved  
10 previously, in the previous approval.

11 MR. SCARBROUGH: Well, it's very similar  
12 to Vermont Yankee's. And except for that portion with  
13 the MSIV closure that Susquehanna is doing, it's  
14 similar. But they don't have that portion in it.

15 MEMBER BONACA: And they don't have the  
16 instrumentation that Susquehanna has?

17 MR. SCARBROUGH: On its dryer filtering.

18 MR. PIERCE: I have a question. Now as I  
19 understand, they have a backup spare dryer. And the  
20 reason as stated before by Davison that they didn't  
21 want to instrument the present dryer because it's  
22 heavily radiated. Has the question ever gotten up as  
23 to why they used their spare dryer and it isn't  
24 radiated at all.

25 MR. SCARBROUGH: There were discussions.

1 That's probably something more for asking the  
2 licensee.

3 MR. DAVISON: Yes. This is Paul Davison.

4 MR. PIERCE: Yes, Paul?

5 MR. DAVISON: That dryer has been sitting  
6 out unprotected near the Delaware Bay for those many  
7 years. So it is not suitable for placement into the  
8 vessel.

9 MEMBER MAYNARD: Also, I'm not sure it  
10 would give any meaningful data. Because as I  
11 understand it, you said that had not been modified. So  
12 it would be a totally different structural --

13 MR. PIERCE: Well, presumably the  
14 modification is not as big a deal as making a new one.

15 MEMBER SIEBER: It's an inferior  
16 structure.

17 CHAIR ABDEL-KHALIK: Well, let's focus on  
18 the presentation, please.

19 MR. PIERCE: Okay.

20 MR. SCARBROUGH: So let's go through the--

21 MEMBER BONACA: And you will deal with  
22 that question?

23 MR. SCARBROUGH: Yes, we will. We can  
24 talk about that during the closed session.

25 MEMBER BONACA: Okay.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. SCARBROUGH: In terms of the  
2 development of license conditions, this is a similar  
3 approach that we've done for Vermont Yankee and  
4 Susquehanna. There's a slow deliberate power  
5 ascension, there's hold points and there's data  
6 evaluation along the way looking for trends and such.

7 The startup test procedure formalizes the  
8 plan for the steam dryer and the plant instrumentation  
9 and all the activities associated with that startup  
10 test procedure.

11 There's a license condition number 3,  
12 which we'll show in a minute, which specifies the  
13 startup test procedure contents.

14 And then the license conditions provide  
15 for licensee and NRC interaction to address plant  
16 data, evaluations, walkdowns, inspections and startup  
17 procedures. Similar to what we've done for the other  
18 plants as well.

19 Okay. So in the next series of slides  
20 I'll try to give a very overview of the license  
21 conditions. They're spelled out in more easily  
22 readable form in the SE itself, but to try to  
23 summarize it in here.

24 License condition number one provides the  
25 overall sort of monitoring that's done during the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 startup power ascension. There's monitoring of the  
2 main steamline strain gauges hourly. There's a hold at  
3 each five percent step for 96 hours, and that's done  
4 to evaluate plant data, look for trends, conduct  
5 walkdowns and then provide that evaluation to the NRC  
6 Project Manager.

7 If a level 1 main steamline limit curve --  
8 DR. WALLIS: Now could you tell me what  
9 you understand by "conduct walkdowns." This is a very  
10 general term.

11 MR. SCARBROUGH: Well, they walk through  
12 the plant and they look for all the areas that are  
13 available, accessible during plant operation. And they  
14 look for anything --

15 DR. WALLIS: So they listen and see if  
16 anything's moving on --

17 MR. SCARBROUGH: They look for things for  
18 any small breaks. You know, at Quad Cities they had  
19 some small drain lines break, things of that nature.

20 DR. WALLIS: Yes.

21 MR. SCARBROUGH: They look through -- they  
22 see what vibration there is. They listen for any  
23 sounds. Because, you know, we've had that happen  
24 before where you could hear the whistling. So they do  
25 that sort of thing.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1                   And then if they see any places that they  
2 need to do any hand held accelerometers, they can do  
3 that as well. So that's the type of thing we expect  
4 them.

5                   And then we discussed that with them  
6 during that hold period to see what they found. And  
7 they usually will have the engineers who were out  
8 doing the walkdowns talk to us on the phone about what  
9 they saw.

10                   DR. WALLIS: Okay.

11                   MEMBER MAYNARD: Will operators also be  
12 part of these walkdowns? Because an experienced  
13 operator can tell if there's a difference --

14                   MR. DAVISON: Yes. This is Paul Davison.  
15                   Equipment operators who are used to doing  
16 the rounds will be part of the walkdown teams.

17                   MR. SCARBROUGH: Then there's monitoring  
18 of the reactor pressure vessel water level  
19 instrumentation and main steamline accelerometers  
20 looking for resonances. This is what we talked about  
21 earlier in terms of if you see resonances that are  
22 starting to increase above normal levels, this is  
23 where you start to see an issue before it hits one of  
24 the limit curves. But if you start to see that  
25 there's resonance starting to occur, you stop the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 power ascension, you evaluate structural integrity of  
2 the dryer and then provide the results to NRC.

3 DR. WALLIS: How do you know resonance has  
4 occurred?

5 MR. SCARBROUGH: As you're monitoring the  
6 instrumentation in the accelerometers and also through  
7 the strain gauges if you start to see through the data  
8 a resonance start to occur --

9 DR. WALLIS: It's the A frequency growing  
10 much more than the other ones?

11 MR. SCARBROUGH: Yes.

12 MEMBER BONACA: So the data is being  
13 recorded somewhere?

14 MR. SCARBROUGH: Yes.

15 MEMBER BONACA: And you're taking probably  
16 the density functions or something to look for peaks.

17 MR. SCARBROUGH: Right.

18 MEMBER BONACA: So you have that in  
19 addition to these walkdowns?

20 MR. SCARBROUGH: Right. Right. It's a  
21 combination of a lot of efforts to look for any  
22 adverse flow effects that may be occurring.

23 And then the last bullet there has the NRC  
24 approval. Now we have modified this somewhat since we  
25 did the slides. There's a license condition number 4,

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 which I'll show you, which talks about if you change  
2 the level 1 performance criteria. And if you change  
3 that, the NRC approval has to be obtained. So we've  
4 adjusted this license condition to match  
5 Susquehanna's, which moved that process from obtaining  
6 NRC approval under license condition number four. So  
7 I'll show that to you in just a minute.

8 MEMBER ARMIJO: Has NRC reviewed and  
9 approved these existing limit curves?

10 MR. SCARBROUGH: The limit curves that we  
11 received, yes. We've seen them and they were part of  
12 the review as part of the safety evaluation  
13 preparation.

14 MEMBER ARMIJO: Right.

15 DR. WALLIS: How do you expect them to do  
16 the second bullet up from the bottom, "evaluate  
17 structural integrity of dryer?" How do you expect  
18 them to do that? They can't get in there, there's no  
19 monitoring in there.

20 MR. SCARBROUGH: Well, they can rerun the  
21 analysis and look for stresses on the dryer.

22 DR. WALLIS: They can redo the analysis,  
23 but they can't actually inspect the dryer itself?

24 MR. MANOLY: No, no. That's not visual.  
25 No, that's not visual.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. SCARBROUGH: No. That's in terms of  
2 mean evaluate it through the --

3 MEMBER BONACA: They can only do this  
4 through some model because they have no direct  
5 measurement in that dryer.

6 MEMBER BANERJEE: Whereas, previously the  
7 condition you put is if the ratio between -- I forget  
8 what it was -- 2.71 or something, the stress  
9 intensification factor.

10 MR. SCARBROUGH: Right.

11 MEMBER BANERJEE: That was a limitation  
12 you could directly put because you could measure the  
13 stresses in the dryer, right?

14 MR. SCARBROUGH: Well, they're not  
15 measuring the stresses in the dryer. They're taking--

16 MEMBER BANERJEE: I know what they are  
17 doing here. This is different.

18 MR. SCARBROUGH: Right.

19 MEMBER BANERJEE: But I recall at  
20 Susquehanna you had a limitation --

21 MR. SCARBROUGH: Right.

22 MEMBER BANERJEE: -- which related to the  
23 relationship between the measured vibration and the  
24 stress -- the vibrations and the stresses. And if  
25 that exceeded a certain ratio, I forget what that

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 magic ratio was, that was a limitation, right?

2 MR. SCARBROUGH: Susquehanna had the  
3 advantage of having direct dryer measurements. I mean,  
4 it's --

5 MEMBER BANERJEE: Yes, you have to run it  
6 on a model, whereas there you did not.

7 MR. SCARBROUGH: Correct. At Vermont  
8 Yankee?

9 MEMBER BANERJEE: Yes. But Vermont Yankee  
10 is quite a bit smaller than this, isn't it? I mean,  
11 what sizes are we talking about? Because this is a  
12 3400 megawatt thermal plant. And what was -- 3339, or  
13 whatever.

14 MR. SCARBROUGH: Right. But the flow rates  
15 are on the same --

16 MEMBER BANERJEE: The flow rates are the  
17 same, but the dimensions are very different.

18 MR. MANOLY: But analytically it's the  
19 same approach.

20 MEMBER SIEBER: It's the same at Vermont.

21 MEMBER BANERJEE: Analytically it's the  
22 same approach, but it's a bigger dryer.

23 MR. MANOLY: Yes, that's correct.

24 MR. SCARBROUGH: Okay. So in terms of  
25 license condition number two, this is discussions of

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 what actions they would take for certain situations.

2 If acoustic resonance challenges the limit  
3 curves, they re-evaluate the dryer loads, re-establish  
4 the limit curves.

5 The update dryer reports at 111.5 and 115.

6 DR. WALLIS: Can I go back? It says  
7 "Monitor RPB water level instrumentation." Now the  
8 water level surely isn't dancing at 150 Hertz or  
9 whatever it is. So what are you actually monitoring in  
10 this water level instrumentation?

11 MR. SCARBROUGH: You're evaluating the  
12 changes if you see a resonance starting to occur.

13 DR. WALLIS: The water level  
14 instrumentation is designed to measure level. It's  
15 not designed to measure high frequency.

16 MR. SCARBROUGH: Right.

17 DR. WALLIS: So does it tell you anything?

18 DR, HAMBRIC: This is Steve Hambric, Penn  
19 State.

20 The reactor pressure vessel water levels  
21 in Quad Cities actually showed that big 150 Hertz peak  
22 that caused all the --

23 DR. WALLIS: So there is a transducer  
24 which pick that up? Because it's usually designed to  
25 measure inches rather than frequency.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 DR, HAMBRIC: Yes. You can pick up  
2 fluctuations. You have to be careful, because you do  
3 get extra frequencies that show up in the lines. But  
4 this is looking for just a disastrous peak --

5 DR. WALLIS: Okay. So it can do that.

6 DR, HAMBRIC: --that is not picked up in  
7 the main steamline strain gauges.

8 DR. WALLIS: Okay.

9 MEMBER BANERJEE: What's the mechanism for  
10 that?

11 DR, HAMBRIC: Big or high volume acoustic  
12 modes within the reactor pressure vessel is pulsing in  
13 and out. And you'll see that in water level.

14 MEMBER BANERJEE: And you couldn't pick  
15 that up in the steamline accelerometers?

16 DR, HAMBRIC: You should. You should.

17 MEMBER BANERJEE: But what happened there  
18 at Quad Cities? Did you pick it up in the main --

19 DR, HAMBRIC: You see it everywhere in  
20 Quad Cities. But when we get to the closed session  
21 there's a certain frequency that we're a little bit  
22 concerned about that we think may be a modeling  
23 artifact. But just to make it's not -- but just to  
24 make sure it is a modeling artifact, we want to  
25 measure the water level sensors and the reactor

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 pressure -- so we'll revisit that in a closed session.

2 MEMBER BANERJEE: And the frequency that  
3 was being picked up at Quad Cities was what frequency?

4 DR, HAMBRIC: 151 and 156 Hertz.

5 MEMBER BANERJEE: And you saw that in the  
6 water level?

7 DR, HAMBRIC: Yes. Saw it everywhere  
8 throughout the --

9 DR. WALLIS: Yes, but it's not on the dial  
10 which says the level is 10 inches or 100 inches. I  
11 mean, that's the response time in seconds --

12 DR, HAMBRIC: Doing a frequency spectrum  
13 of the pressure --

14 DR. WALLIS: But that actually comes out  
15 of there. Okay.

16 MEMBER BANERJEE: And the water level  
17 sensors are what? Are they DP measurements? How are  
18 they being measured, the water levels? DPs?

19 DR. WALLIS: Well, they can't be measuring  
20 DP without frequency, surely.

21 MEMBER BANERJEE: It's probably just  
22 measuring acoustic waves then going through.  
23 Otherwise, how could they -- 150 frequencies seems a  
24 very high frequency to pick up --

25 DR, HAMBRIC: Well, we could share the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 data with you if you like.

2 MEMBER BANERJEE: Yes, it would be  
3 interesting.

4 DR, HAMBRIC: There's a very clear  
5 frequency spectrum --

6 MEMBER BANERJEE: And how big were these  
7 fluctuations?

8 DR, HAMBRIC: Massive. Three orders of  
9 magnitude above any --

10 DR. WALLIS: No, no, no. I mean how big  
11 were the level fluctuations?

12 DR, HAMBRIC: Oh, I don't remember that.

13 MEMBER BONACA: Okay.

14 CHAIR ABDEL-KHALIK: Could you identify  
15 yourself?

16 MR. BILANIN: Yes, My name is Alan Bilanin  
17 from Continuum Dynamics Incorporated.

18 Quad Cities down in the instrument rack on  
19 the referenced legs, the water legs, there's plenty of  
20 ports where in fact transducers can be installed. And  
21 one of the first things that Quad Cities did when they  
22 were seeing flow induced vibration was make sure they  
23 had transducers there that can pick up this higher  
24 frequencies. They actually had an instrumentation  
25 system which was designed to look at any high

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 frequency fluctuations up to 200 Hertz or so.

2 MEMBER BANERJEE: Were these DP or were  
3 they just absolute pressure?

4 MR. BILANIN: Oh, they're DP.

5 MEMBER BANERJEE: So you have seen  
6 fluctuations in DP, not just in pressure?

7 MR. BILANIN: That's correct.

8 MEMBER BANERJEE: How large were these  
9 fluctuations?

10 MR. BILANIN: It's been four years now.  
11 I don't recall, but I did have the data and I did  
12 analyze the data four years ago.

13 When we realized that there was a  
14 significant oscillation there, that's when the system  
15 was developed to place strain gauges around the main  
16 steamlines, and that became the method to measure the  
17 amplitude of the pressure fluctuations.

18 DR. WALLIS: I think I understand now.  
19 You're not really measuring fluctuations in water  
20 level. You're measuring pressure fluctuations at the  
21 end of the water level lines, which is quite a bit  
22 different?

23 MR. BILANIN: That's correct.

24 DR. WALLIS: Okay.

25 MEMBER BANERJEE: There's no way the water

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 level could be -- beyond any science I've known.

2 DR, HAMBRIC: And there is over a  
3 fluctuation of 1 psi at Quad Cities.

4 MEMBER BANERJEE: So you're bouncing  
5 acoustic waves off, that's all you're measuring?

6 DR, HAMBRIC: Yes.

7 MEMBER BANERJEE: Okay.

8 MR. SCARBROUGH:

9 MR. PIERCE: So it terms of license  
10 condition number two, as I mentioned, they update the  
11 dryer reports. IF they challenge a limit curve, they  
12 perform a structural re-evaluation. They're going to  
13 be revising the plant procedures to reflect the long  
14 term monitoring for potential dryer failure.

15 They're revising the inspection program to  
16 match the BWRVIP-139 guidelines.

17 They're submit a final load definition  
18 once they complete the power ascension testing.

19 DR. WALLIS: There's nothing here --  
20 excuse me -- about the moisture carry over that we had  
21 a discussion about. Were you here for that  
22 discussion?

23 MR. SCARBROUGH: Yes. That's part of --

24 DR. WALLIS: It is, but it doesn't appear  
25 to be part of your discussion here.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. SCARBROUGH: It's in the startup test  
2 procedure that they -- the next slide.

3 DR. WALLIS: Do you sort of agree with our  
4 conclusion that the water carry over, you know if  
5 something drastic happen, you might notice something  
6 but it's not as good of indication as these other  
7 indications?

8 MR. SCARBROUGH: Right. It's not as good  
9 as, you know, if you see a resonance, you're going to  
10 see it in the strain gauge data. And so that's going  
11 to be more proactive. Most -- after the fact. So  
12 that's why --

13 DR. WALLIS: It might indicate something  
14 catastrophic, you know.

15 MR. MANOLY: Yes, sudden rise step  
16 function then you would know this.

17 MR. SCARBROUGH: Right. But when they look  
18 for trends, that's one of the parameters they're going  
19 to be trending because there was an indication of  
20 data. And increase gets a lot of attention by the  
21 staff when we hear about it.

22 So license condition number three has the  
23 startup test procedure contents about it indicates the  
24 test procedures, it includes dryer acceptance  
25 criteria, the limit curve, the hold points, the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 inspections and walkdowns, the acceptance criteria and  
2 the verification for all those planned activities. So  
3 then that's laid out in much more detail in the  
4 license issue itself.

5 And then three more license conditions  
6 number 4 has to do with when you make aspects of the  
7 power ascension plan less restrictive. And one of  
8 those is the level 1 performance criteria where if you  
9 have a level 1 limit curve exceeded and the licensee  
10 wants to go back and adjust that level 1, you can't do  
11 that without NRC approval. So this is the same point  
12 that we raised with Susquehanna where there is this  
13 hold there where if you need to change that to show  
14 that you're meeting level, they have to come back to  
15 the staff.

16 The next license condition number five has  
17 to do with the visual inspection. It's this ongoing  
18 process for doing several dryer inspections using the  
19 BWRVIP-139 guidelines.

20 And then they provide the inspection  
21 results through a series of reports to us. There's a  
22 90 day report after startup and then there is a 60--

23 DR. WALLIS: So they inspect the dryer  
24 while it's running.

25 MR. SCARBROUGH: No. During the refueling

1 outage.

2 DR. WALLIS: Well, how can you get within  
3 a 90 day? You going to shutdown the plant within 90  
4 days of startup to inspect the dryer?

5 MR. SCARBROUGH: Oh, that's startup  
6 following the outage to inspect the dryer.

7 DR. WALLIS: Oh, following the outage.  
8 Thank you.

9 MR. SCARBROUGH: Yes. Thank you. I was  
10 trying to crunch these licensing conditions down to  
11 just a slide. Sorry. So it comes out a little funny.

12 But after 90 days after startup they give  
13 those results. And within 60 days of completing the  
14 power ascension testing, they give us the dryer and  
15 structural integrity report. And then there's a  
16 supplemental report within 60 days once they finish  
17 all of the EPU power ascension --

18 MEMBER BANERJEE: So when are these  
19 inspections actually taking place?

20 MR. SCARBROUGH: During the fueling  
21 outage.

22 MEMBER BANERJEE: Which is when?

23 MR. DAVISON: Paul Davison.

24 The next refuel outage following the  
25 online implementation will be in 2009, spring.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 March/April time frame.

2 MEMBER BANERJEE: And when will you be at  
3 full power if you ascended all the way up?

4 MR. DAVISON: Our target is June 1st of  
5 this year.

6 MEMBER BANERJEE: Okay. So it's about a  
7 year after, roughly, eight months or nine months or  
8 something like that?

9 MR. DAVISON: Approximately nine months.

10 MEMBER BONACA: Okay.

11 CHAIR ABDEL-KHALIK: Is there a condition  
12 similar to five after the cycle in which the full EPU  
13 is implemented? After the 15 percent?

14 MR. DAVISON: Yes. Yes.

15 CHAIR ABDEL-KHALIK: Thank you.

16 MR. SCARBROUGH: And then the last two  
17 license conditions we have there's an expiration--

18 MEMBER BANERJEE: Just -- the next  
19 refueling outage after the spring 2009 will be when?

20 MR. DAVISON: That would be the fall of  
21 2011.

22 MEMBER BANERJEE: Okay.

23 DR. WALLIS: And seven means all license  
24 conditions expired or what?

25 MR. DAVISON: 2010.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 DR. WALLIS: What's --

2 MEMBER BANERJEE: The fall of 2010 or  
3 finish?

4 MR. SCARBROUGH: All of the dryer  
5 inspections and they find no unacceptable flaws or  
6 unacceptable fatigue due to fatigue, that's when it  
7 expires. So there's --

8 DR. WALLIS: So all the license conditions  
9 one to six expire? But it doesn't say which license  
10 condition it expires.

11 MR. SCARBROUGH: Right. Yes.  
12 Once they get to that point, they accomplish  
13 everything, the startup for power ascension testing is  
14 done, you know they've done all of that, they've done  
15 all the dryer inspections this is s way to sort of  
16 sunset all of these conditions.

17 MEMBER BANERJEE: "All the dryer  
18 inspections" means two refueling outages?

19 MR. SCARBROUGH: Right. All the way down.

20 DR. WALLIS: Don't you need to say license  
21 conditions expire, don't you?

22 MR. SCARBROUGH: Yes. It probably says  
23 that in the more detailed words.

24 DR. WALLIS: Okay.

25 MR. SCARBROUGH: But, yes, that's right.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MEMBER BANERJEE: So in time that would be  
2 fall to 2010 or 18 months after that?

3 MR. DAVISON: Yes, this is Paul Davison.

4 The next outage would be the  
5 September/October time frame of 2010.

6 MEMBER BANERJEE: And then if no flaws are  
7 found, then all these would expire at that point?

8 MEMBER STETKAR: IT would be spring of  
9 2012. One more.

10 MEMBER BANERJEE: One more.

11 MEMBER MAYNARD: But also I believe they  
12 said they're not committing to go to the full EPU.

13 MR. SCARBROUGH: Right.

14 MEMBER MAYNARD: That may be delayed an  
15 outage or two. So those years flip out. Because it's  
16 two years after the implementation, two outages after  
17 the full implementation.

18 MEMBER BANERJEE: Oh, so the spring 2009  
19 doesn't count here, that's what you're saying as an  
20 outage? They're going to do an inspection then, but  
21 they may not be at full licensed EPU at that point.

22 MEMBER MAYNARD: They will not be.

23 MEMBER BANERJEE: Will not be.

24 MEMBER MAYNARD: Will not be.

25 MEMBER BANERJEE: So only after they go to

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 full license EPU, whenever that is, if they ever do,  
2 it'll be two outages after that?

3 MR. SCARBROUGH: Yes, sir. That's true.  
4 That's true.

5 And the last one there is the one I had  
6 mentioned earlier is we're providing the level 1 main  
7 steam safety valve vibration acceptance criteria  
8 before they exceed their current license level power  
9 just so they can make sure we have a baseline and they  
10 have criteria for monitoring that as well. And that  
11 comes from the Quad Cities issues regarding their  
12 electro-mater relief valves. So we had a concern.

13 So in conclusion for the open session, we  
14 talked about all the components that we went over, we  
15 considered that they'll continue to meet the general  
16 design criteria following EPU implementation.

17 There's reasonable assurance exists that  
18 the Hope Creek steam dryer is within its structural  
19 limits for CLTP and extrapolated EPU conditions. And  
20 we consider the EPU amendment acceptable with respect  
21 to component evaluation.

22 And then we consider the license  
23 conditions will establish provisions for monitoring  
24 and for evaluating plant data and taking prompt action  
25 if necessary.

1 DR. WALLIS: Of course if you were a  
2 probabilistic person you would cast this reasonable  
3 assurance in terms of a probability of success and not  
4 just in vague terms like reasonable assurance. It's  
5 very dangerous to assess the probability that there  
6 will be a problem with the dryer. And that's the way  
7 I would measure the success of your decision. If you  
8 said there's a chance of one in 100 and then it  
9 happens, or if you said there's a chance of one in a  
10 million and then it happens; that tells me something  
11 about the quality of your decision.

12 In this case you wouldn't hazard a  
13 probability of the dryer actually showing flaws after  
14 EPU?

15 MR. SCARBROUGH: No, sir. Because it was  
16 deterministic evaluation where the analyses showed  
17 that the fatigue limits would not be reached with the  
18 margins --

19 DR. WALLIS: So it's a judgmental thing?  
20 You just made a judgment.

21 MR. MANOLY: Deterministic.

22 MEMBER BANERJEE: It depends a lot on the  
23 loads that the calculation, that's extrapolating  
24 significantly from the current database based on some  
25 form of modeling.

1 MR. SCARBROUGH: Right.

2 MR. MANOLY: And benchmarking. Against  
3 Quad Cities.

4 MEMBER BANERJEE: Well, but it's not the  
5 same as Quad Cities. I mean, we've been through this  
6 argument with Susquehanna in detail where Quad Cities  
7 is very different in some ways than these dryers are.  
8 I mean, you have a frequency of 150 whereas the  
9 Susquehanna dryers you had 15. I mean --

10 MR. MANOLY: But the tool is being used,  
11 that's what we're --

12 MEMBER BANERJEE: But the tool was not the  
13 same thing either. It was being revised continuously,  
14 if I remember, at least at the time of Susquehanna

15 MR. SCARBROUGH: We'll talk about that  
16 revision again during closing.

17 CHAIR ABDEL-KHALIK: At this time we'll  
18 take a 15 break and reconvene at 10:45 for a closed  
19 session.

20 (Whereupon, at 10:30 a.m. a recess until  
21 10:46 a.m.)

22 CHAIR ABDEL-KHALIK: Before we switch to  
23 a closed session, the licensee and its consultants  
24 would like to present some information that was  
25 requested during the earlier session. So, thank you.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. SCHROLL: I'm Ed Schroll. I'm from GE-  
2 Hitachi. The information is on the Susquehanna steam  
3 dryer.

4 The Susquehanna steam dryer, the new one,  
5 the plates and channels have been beefed up by  
6 approximately two times what the original dryer was.

7 Also, in that new dryer we have used non-  
8 sensitized material to avoid IGSCC.

9 Also another modification has been to  
10 remove most of the fillet welds and replace them with  
11 full penetration welds.

12 CHAIR ABDEL-KHALIK: Thank you. If there  
13 is any additional information you would like to  
14 present in the open session? No?

15 MR. DAVISON: No.

16 CHAIR ABDEL-KHALIK: Okay. So at this  
17 time we will go into a closed session.

18 (Whereupon, at 10:47 a.m. the meeting went  
19 into a closed session to reconvene in open session at  
20 3:00 p.m.)

21 CHAIR ABDEL-KHALIK: We are back in  
22 session. This is an open session. Before we get  
23 started, the applicant would like to make a statement  
24 about a table that was distributed.

25 MR. DAVISON: Yes, Paul Davison, PSEG.

1           On the first day we handed out a chart  
2           that looked like this for the power ascension testing.  
3           This updated chart that we provided to show all the  
4           way through 115 percent that was the second chart we  
5           handed out today with the packet, we made a  
6           transcription error in the moisture carryover column.  
7           It shows an X in every percent power. They are two  
8           and a half percent increases. We will provide Zena an  
9           updated chart to reflect that error for the second  
10          graph that we provided.

11                   MEMBER ARMIJO: So there should be some  
12          blanks there?

13                   MR. DAVISON: That is correct.

14                   MEMBER BANERJEE: Two and a half percent?

15                   MR. DAVISON: Correct.

16                   CHAIR ABDEL-KHALIK: At this time we'll  
17          continue with the presentation. And the staff will  
18          begin the presentation with item number 19 on the  
19          agenda.

20                                   19. PLANT SYSTEMS

21                                   NRC STAFF REVIEW OF EPU TEST PROGRAMS

22                   MR. PETTIS: Good afternoon. My name is  
23          Bob Pettis. I am with the Quality and Vendor Branch,  
24          which is a part of the Division of Engineering in NRR.  
25          And I have a brief presentation on the staff's review

1 of more of the programmatic aspects of our ascension  
2 testing program with some emphasis on the transient  
3 testing issue.

4 On the second slide, we just have a little  
5 introduction. And the standard review plan is used by  
6 the staff to perform its review in this area. It's  
7 SRP 14.2.1, titled "Generic Guidelines for Standard  
8 Power Uprate Testing Programs" specifically developed  
9 for EPUs. It provides guidance for the staff reviews  
10 of the proposed EPU test programs. Its primary basis  
11 is based on reg guide 1.68 requirements, which were in  
12 place for initial plant test programs.

13 Just in the way of a little history, the  
14 SRP was developed back in the 2003 time frame. There  
15 was a final version that was published by the staff in  
16 2005. And we have had several meetings with the  
17 Committee with respect to the content and the  
18 philosophy embodied in the standard review plan.

19 The reason for its development, it had to  
20 do with the development of the review standard, which  
21 is used for all power uprates, which is RIS-001. And  
22 basically at the time that the review standard was  
23 being developed, we needed an extra piece of  
24 proceduralized guidance in order for us to do a  
25 comprehensive review for EPU. So as part of the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 review standard process, this document was developed.

2 In general, the EPU test program should  
3 include sufficient testing to demonstrate that SSCs  
4 will perform most satisfactorily at the proposed  
5 uprated power level. The EPUs to date that the staff  
6 has reviewed has been somewhere on the area of about  
7 19 to 20 total in the EPU category, which is basically  
8 the requests that are above 7 percent.

9 Staff guidance considers the original  
10 power ascension test program and the extent of any  
11 EPU-related modifications. The SRP guidance  
12 acknowledges that licensees may propose alternative  
13 approaches to testing, which would have to have  
14 adequate justification.

15 Specific review and acceptance criteria  
16 are provided in the SRP for the staff evaluation.  
17 That refers to section 3(c) of the SRP, in which we  
18 have a series of criteria. It is about six to seven  
19 that the staff uses as a means of evaluating any  
20 justifications for not performing certain original  
21 start-up testing.

22 Our group, which is in the Division of  
23 Engineering, primarily we look at the programmatic  
24 aspects of the power ascension test program. And then  
25 we receive technical inputs from other technical

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 branches.

2 In this presentation, which is a short  
3 presentation for today but it embodies about 15 or 18  
4 pages of the safety evaluation -- and so just so that  
5 you're aware, there are inputs from the Plant Systems  
6 Branch along with Reactor Systems Branch and some  
7 input from the PRA Technical Branch as well. So it's  
8 a consolidated review. And basically all of that  
9 detail is contained in the safety evaluation.

10 The program at Hope Creek consists  
11 primarily of steady state testing, does not include  
12 performance of large transient testing, which has been  
13 defined as the MSIV closure test and the generator  
14 load rejection test.

15 These two tests have been included back in  
16 the General Electric topical report, which was the  
17 LTR-1. We have had discussion probably for the last  
18 five to six years with respect to performance of these  
19 tests. And for the bulk of the BWR applications, they  
20 have basically all addressed the same criteria, which  
21 is General Electric's CPPU guidance and also plant  
22 performance of the rest of the BWR fleet.

23 The test program will monitor important  
24 plant parameters during EPU power ascension. Tech  
25 spec surveillance and post-mod testing will confirm

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 performance capability of the modified components.

2 The power ascension follows staff-approved  
3 GE CPPU topical report. The staff wrote a safety  
4 evaluation back in about the 2005, 2004 or '05, time  
5 period, which was a review of the GE CPPU topical  
6 report.

7 PSEG's justification for not performing  
8 the two large transient tests: address the review  
9 criteria discussed in SRP 14.2.1, which is consistent  
10 with previous staff-approved EPU's. These criteria  
11 basically are the ones that I described earlier that  
12 are in section 3(c) of the SRP.

13 Some of the justifications include  
14 industry operating experience, including unplanned  
15 events at Hope Creek involving turbine trips and  
16 generator load rejection, which produce expected  
17 results. I don't believe there are any MSIV events  
18 that I can remember back that we could add to this.  
19 They were basically turbine trips or generator load  
20 rejections.

21 No new thermal hydraulic phenomena or new  
22 system interactions were identified; the limited scope  
23 of EPU mods for balance-of-plant systems, again, using  
24 the CPPU approach.

25 Transient evaluations were performed by

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 GE, included large transient testing at full EPU  
2 conditions, which is referenced in the Hope Creek  
3 power uprate safety analysis report, no unique  
4 limitations associated with conformance to analytical  
5 methods.

6 Our technical counterparts and their  
7 reactor systems have been busy over the years looking  
8 at whether or not the performance of these two tests,  
9 the MSIV and the generator load rejection, were needed  
10 to validate any of the existing plant safety codes  
11 that are used in the EPU approach. And it keeps  
12 coming up that they are not needed for code  
13 benchmarking or validation.

14 PSEG's conformance to NRC staff-approved  
15 GE LTRs, again, the staff approved the LTR-1 and the  
16 LTR-2 and the CPPU topical approach.

17 The staff summary is that the SRP allows  
18 for the justification of the transient testing is not  
19 needed for code analysis and benchmarking, which is  
20 consistent with previous plants, with the exception of  
21 Browns Ferry unit 1, which was the only other plant  
22 that we required for a license condition that they do  
23 the testing.

24 The staff considered the operating history  
25 at the plant, industry experience within the BWR

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 community, and the fact that there is no introduction  
2 of any new credible thermal hydraulic phenomena;  
3 limited scope of EPU mods; and conformance to the  
4 staff-approved GE topical report.

5 And, in conclusion, the proposed EPU test  
6 program satisfies the review and acceptance criteria  
7 that's contained in 10 CFR 50, appendix B, criterion  
8 XI, which is "Test Control," and that the proposed EPU  
9 test program addresses the guidance and the review  
10 criteria established in the SRP for EPUs.

11 CHAIR ABDEL-KHALIK: Thank you, Mr.  
12 Pettis.

13 MR. PETTIS: Okay.

14 CHAIR ABDEL-KHALIK: Are there any  
15 questions for Mr. Pettis?

16 (No response.)

17 CHAIR ABDEL-KHALIK: If not, we'll move on  
18 to item 20 on the agenda. And I ask the applicant to  
19 make that presentation.

20 20. PROBABILISTIC SAFETY ASSESSMENT

21 DR. BURNS: Good afternoon. My name is Ed  
22 Burns. I am the Hope Creek risk management team  
23 technical leader. And I am responsible for the Hope  
24 Creek PRA development implementation and its  
25 applications. Thank you for this opportunity to

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 discuss the effects of EPU and the Hope Creek risk  
2 profile.

3           The next slide, the first slide,  
4 identifies the purpose of the EPU risk evaluation.  
5 What we want to do is provide a risk perspective  
6 regarding the effect of EPU implementation using  
7 standard probabilistic risk assessment techniques to  
8 complement the deterministic licensing requirements  
9 and to confirm the appropriateness of the changes.  
10 This is accomplished by estimating the change in  
11 full-power internal event CDF and LERF produced by EPU  
12 implementation.

13           We are using the available probabilistic  
14 models for Hope Creek. And we shall also identify  
15 qualitatively the changes in risk from other sources;  
16 for example, external events and shutdown  
17 configurations produced by EPU implementation using  
18 insights from Hope Creek.

19           The results are compared with the reg  
20 guide 1.174 for the risk significance of the changes  
21 where the significance is described by acceptance  
22 guidelines and the risk matrix defined by the NRC.

23           The next slide gives an overview of the  
24 risk evaluation process. This is a summary of both  
25 the process and the guidance we used, plus the risk

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 matrix that we used. First of all, the EPU submittal  
2 is based on deterministic evaluation of licensing  
3 criteria and is not a risk-informed submittal.  
4 Nevertheless, the quantitative risk perspective is  
5 developed and is based on reg guide 1.174, which  
6 provides quantitative measures and acceptance  
7 guidelines for use by decision-makers.

8 Quantitative risk matrix chosen by the NRC  
9 in 1.174 are the core damage frequency and the large  
10 early release frequency. These acceptance guidelines  
11 consider both the initial values and the magnitude of  
12 changes in CDF and LERF.

13 As a note, the baseline CDF and LERF must  
14 be below thresholds to make a plant eligible for the  
15 changes to the regulatory licensing process. And the  
16 Hope Creek CDF and LERF are sufficiently low to allow  
17 consideration of these changes by the NRC.

18 The next slide summarizes the topics for  
19 the presentation, which are aligned directly with the  
20 EPU risk evaluation methods. We first identify the  
21 plant configuration and procedural changes that were  
22 part of the EPU upgrade. And then we use the updated  
23 PRA models. The PRA models are developed consistent  
24 with the ASME PRA standard and incorporate peer review  
25 comments.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1                   We then identify those PRA elements  
2 affected by the changes, such as the success criteria,  
3 the human errors, and initiating event changes. Once  
4 this is completed, we then incorporate the EPU  
5 hardware and procedure changes in the PRA model along  
6 with using realistic success criteria and limits as  
7 part of the model implementation.

8                   Finally, the PRA model quantification is  
9 performed on the current plant and the EPU plant to  
10 calculate the change in risk matrix. And the results  
11 compared with the reg guide 1.174 acceptance  
12 guidelines.

13                   Next slide. The identification of the  
14 changes with potential to influence the risk profile  
15 can be then correlated with possible PRA elements  
16 affected. The predominant influence on the risk  
17 changes is derived from the increase in power level  
18 and the associated reduction in margins, feedwater  
19 response issues, higher nominal flows, reduced  
20 reaction times in the power ascension testing.

21                   Those influences can change the success  
22 criteria, the human reliability analysis, the system  
23 fault trees that feed into the accident sequence  
24 analysis, and the core melt progression timing.

25                   MEMBER STETKAR: Ed, can I interrupt you

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 --

2 DR. BURNS: Sure.

3 MEMBER STETKAR: -- for just a second? I  
4 read through all this stuff. It makes a lot of sense.  
5 I really like your models for SRV challenges and  
6 things.

7 I have one question. Does the increased  
8 power level -- I don't know how HPIC/RCIC are  
9 controlled here at Hope Creek. Does the model include  
10 cyclic behavior of HPIC/RCIC and other --

11 DR. BURNS: Yes.

12 MEMBER STETKAR: -- pull a high-level  
13 trip?

14 DR. BURNS: Yes.

15 MEMBER STETKAR: Does the increased power  
16 level increase the number of cycles of RCIC, for  
17 example, for transient response? It would seem that  
18 it would.

19 DR. BURNS: We include a number of cycles  
20 for HPIC and RCIC before the operator takes control,  
21 but he's directed. And I'll defer.

22 MEMBER STETKAR: So you do have an  
23 operator action to manually control flow also?

24 DR. BURNS: Yes.

25 MEMBER STETKAR: Because I didn't see

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 either of those things in your discussion of delta for  
2 pre-EPU/post-EPU, either number of cycles before he  
3 takes control or even in the HRA a time window for him  
4 to take control. It was one of the questions I had  
5 about --

6 DR. BURNS: Right.

7 MEMBER STETKAR: -- the deltas.

8 DR. BURNS: Right. We included the top 20

9 --

10 MEMBER STETKAR: Operator actions.

11 DR. BURNS: -- operator actions based upon  
12 importance. In preparation for this and subsequent to  
13 the calculations that were done for the EPU submittal,  
14 we went back and looked at all of the HEPs to see what  
15 they were. But even then, that operator action was  
16 below the risk achievement worth that we looked at for  
17 those cases.

18 MEMBER STETKAR: At the value that you  
19 would use --

20 DR. BURNS: Right.

21 MEMBER STETKAR: -- before? Let me ask,  
22 do you know or does someone at Hope Creek know -- it  
23 relates to a different question that I have also on  
24 systems level -- the number of -- if you just modeled  
25 RCIC behavior, operator hands-off until you get down

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 to RHR entry conditions, how does the number of RCIC  
2 cycles change over that period pre-EPU versus  
3 post-EPU?

4 MR. KOPCHICK: Sir, this is Bill Kopchick.  
5 I am a shift operations superintendent at Hope Creek.

6 Would this be under an appendix R-type  
7 shutdown from remote shutdown panel?

8 MEMBER STETKAR: No. I'm talking about  
9 normal transient response. Take an MSIV closure,  
10 vessel isolation event. And have you run out  
11 transients to look, operator hands-off, number of RCIC  
12 cycles, pre-EPU versus post-EPU?

13 MR. KOPCHICK: I wouldn't be able to  
14 answer whether or not we would do that operator  
15 hands-off. The expectation for the operator would be  
16 to take control of the RCIC system or the HPIC system  
17 if required under, say, a small break LOCA condition  
18 and adjust the flow controller.

19 MEMBER STETKAR: Okay. Let me get back to  
20 Ed, then. In the PRA model, do you do that after the  
21 first cycle, after the first trip and restart or --

22 DR. BURNS: We include ten challenges, so  
23 ten cycles and then --

24 MEMBER STETKAR: Ten cycles. Okay.

25 DR. BURNS: Ten cycles for both.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MEMBER STETKAR: Have you got any idea  
2 what the time frame -- then I'll ask it to you this  
3 way. Have you got any idea what the time frame is  
4 pre-EPU versus post-EPU to get those ten cycles?

5 DR. BURNS: I think that it's on the order  
6 of four hours.

7 MEMBER STETKAR: Okay. Thank you.  
8 Continue.

9 DR. BURNS: The configuration changes  
10 associated with the EPU changes involve the BOP  
11 arrangement flow margins again, recirc runback. And  
12 those can influence the HRA. The system fault trees  
13 are the initiating events.

14 The hardware changes include physical  
15 changes. Those are mostly changes in kind, some  
16 reliability changes and set point changes. And those  
17 can affect the accident sequence response system fault  
18 trees and initiating event frequencies.

19 Procedure changes, which in terms of the  
20 PRA or the risk analysis, the ones that were of most  
21 interest were the ones that affected the EOP limit  
22 curves for pressure suppression pressure in HCTL. And  
23 those occurred later in the accident sequences where  
24 the change in risk was very small.

25 Next slide.

1 DR. WALLIS: Let me ask you this time.  
2 When we see other power uprates, usually what seems to  
3 dominate the change in risk is the reduced time  
4 available for human action. Is that the case here?

5 DR. BURNS: The dominant contributor here  
6 is the time available for operator action, yes.

7 DR. WALLIS: So it's the same as at other  
8 plants, right?

9 DR. BURNS: Correct. I can't say  
10 numerically, but it's --

11 DR. WALLIS: No, but it's qualitative.  
12 It's the dominant --

13 DR. BURNS: It's the one in this. So  
14 those are the plant changes. Now the updated PRA  
15 model I would like to talk about. The Hope Creek PRA  
16 model scope and quality are adequate to provide a  
17 realistic perspective on the EPU implementation. And  
18 the following description in this slide is the basis  
19 for the PRA pedigree.

20 We are using the internal events PRA  
21 developed in accordance with the ASME PRA standard to  
22 meet capability category II. Historically the PRA  
23 subsequent to the IPEEE had been subjected to an  
24 industry peer review conducted in 1999. And that peer  
25 review was then incorporated into a rather extensive

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 model modification that was performed in 2003 to  
2 resolve all of the peer review recommendations and to  
3 formulate a model to meet the ASME standard.

4 This was confirmed by a PRA  
5 self-assessment against the standard addendum B in  
6 June 2006, when we confirmed that 92 percent of the  
7 supporting requirements mete the capability category  
8 II, where our conclusion was that that was consistent  
9 with the PRA quality that was commensurate with the  
10 role the PRA plays in decision-making.

11 In addition to that for the other hazards,  
12 we use the IPEEE insights for external events in the  
13 plant-specific shutdown evaluation plus other PSAs for  
14 shutdown conditions to address but not to quantify the  
15 risk associated with those hazards and configurations.  
16 These other hazards are assessed to be very small  
17 contributors to the delta or change in risk associated  
18 with the EPU implementation.

19 Next slide. So that's the base PRA Model  
20 and the changes. Now I would like to consider how  
21 those identified changes influence the --

22 DR. WALLIS: Let me ask you -- I'm sorry.  
23 Your CDF is very low, relatively speaking.

24 DR. BURNS: No, no.

25 DR. WALLIS: Isn't it?

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 DR. BURNS: The CDF is about in the middle  
2 or in --

3 DR. WALLIS: The middle.

4 DR. BURNS: -- the top of the base CDF for  
5 BWRs.

6 DR. WALLIS: Do you recall an estimate of  
7 the fire risk?

8 DR. BURNS: I can talk about fire risk.

9 DR. WALLIS: It's close to -5. Okay. Is  
10 fire risk comparable with these internal events?

11 DR. BURNS: The internal events PRA is  
12 developed according to an ASME PRA standard. There is  
13 no standard for the fire analysis.

14 DR. WALLIS: But there is an IPEEE. So  
15 you have made estimates of fire risk, right?

16 DR. BURNS: There was an IPEEE analysis  
17 that was actually quantified --

18 DR. WALLIS: Do you know if the fire is  
19 comparable with the --

20 DR. BURNS: That analysis showed that the  
21 fire risk was significantly larger than the internal  
22 events PRA. However, in my judgment, the conservative  
23 biases that are in that fire analysis make the  
24 comparison misleading.

25 DR. WALLIS: Yes. But it still is

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 impressive how big it looks.

2 DR. BURNS: Yes.

3 DR. WALLIS: Is there anything in the EPU  
4 that would significantly enhance the fire risk?

5 DR. BURNS: We looked at the fire analysis  
6 in the following way. We didn't see any increase in  
7 combustible loading that would be an issue. We didn't  
8 see any new fire-initiating events that would increase  
9 the fire frequency.

10 We looked at the changes in the PRA that  
11 we implemented as part of EPU to support the internal  
12 events. If you do that, then that conditional core  
13 damage probability when applied to the pervious fire  
14 analysis would reduce that fire frequency by a factor  
15 of four.

16 We also looked at --

17 MEMBER STETKAR: How did you make that  
18 determination?

19 DR. BURNS: Well, if you transferred the  
20 conditional core damage probability from the internal  
21 events to --

22 MEMBER STETKAR: You're the source of that  
23 calculation?

24 DR. BURNS: No.

25 MEMBER STETKAR: Okay. I'll beat up the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 guys who are, then, later. How did you make the --  
2 you said a reduction of core. That's a nice number.  
3 It means you must have done some analysis or is that  
4 reduction of core strictly related to the ratio of the  
5 internal events total CDF?

6 DR. BURNS: It's strictly related to the  
7 --

8 MEMBER STETKAR: So there's no basis for  
9 that number?

10 DR. BURNS: No. I disagree that there is  
11 no basis, but --

12 MEMBER STETKAR: Well, given the fact that  
13 you have modeled most of the fires as losses of  
14 off-site power or MSIV closure-initiating events,  
15 there is no reason to believe that an average change  
16 in the internal event core damage frequency has any  
17 relation to the types of scenarios that are initiated  
18 by fires.

19 I've just made my point. Let me ask a  
20 question in a different way.

21 DR. BURNS: I can tell you why I think the  
22 fire analysis is biased.

23 MEMBER STETKAR: I understand why it might  
24 be biased. Let me ask probably what Graham is looking  
25 for also in a little bit different way. When you

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 compared the seismic risk, which is also derived from  
2 some approximate IPEEE model, as I read, the RAIs and  
3 responses, to me a reasonably convincing argument --  
4 you went through five scenarios, and you said, "Here  
5 is the difference between the IPEEE sort of  
6 understanding, the pre-EPU PRA model" and then "Here  
7 is how we would expect the pre-EPU, the post-EPU."  
8 And some things are not affected because seismic fails  
9 everything. A couple of the sequences were affected.  
10 And there was a fairly compelling argument,  
11 semi-qualitative, semi-quantitative.

12 Why didn't you do the same thing for the  
13 fires? There are only 16 scenarios.

14 DR. BURNS: We did do that. What we  
15 looked at was examined the critical fire scenarios  
16 from the IPEEE and those sequences where we had a loss  
17 of equipment or access to equipment as a result of the  
18 fire. And, therefore, whether it was pre-EPU or EPU  
19 didn't make a difference in those cases because the  
20 timing wasn't a factor because I didn't have access to  
21 controlling that equipment.

22 Those accounted for approximately 75  
23 percent of the fire risk profile.

24 MEMBER STETKAR: Does that mean the fire  
25 led directly to core damage or --

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 DR. BURNS: Right, correct.

2 MEMBER STETKAR: Ah. Okay.

3 DR. BURNS: And then a portion of the  
4 remaining 25 percent were related to a loss of DHR  
5 sequences, where I do have an extended period of time  
6 to take some action to respond to the event.

7 So that analysis or that evaluation of  
8 what existed as the dominant contributors in the fire  
9 PRA from the IPEEE plus our assessment of what  
10 conservative biases existed in the analysis related to  
11 both the initiating event frequencies for fire, the  
12 fire damage models, the treatment of human error  
13 probabilities, and response to accidents, fire-induced  
14 accidents and the fire suppression capability that  
15 wasn't realistically incorporated led us to the belief  
16 that the total fire contribution was significantly  
17 below the previous one and that the delta fire risk  
18 was comparably low.

19 For this particular topic, though, I'm  
20 less interested in the total as I am in the delta --

21 DR. BURNS: Correct, but the total --

22 MEMBER STETKAR: -- pre-EPU and post-EPU.

23 DR. BURNS: -- total does influence the  
24 delta.

25 MEMBER STETKAR: That's true, but I am

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 interested to understand how the fire risk changed  
2 pre-EPU/post-EPU first and a convincing argument to  
3 tell me, did it increase? And my best estimate is  
4 that it would increase because of shorter time  
5 windows, slight changes in some of the success  
6 criteria.

7 The magnitude of that increase, the  
8 absolute magnitude of that increase, is a different  
9 subject.

10 DR. BURNS: Right.

11 MEMBER STETKAR: And in the things that I  
12 read, I didn't find a convincing argument to tell me  
13 that it would increase pre-EPU to post-EPU or any way  
14 to give me an idea, would it increase by a small  
15 amount, a moderate amount, or reasonably large amount.

16 And I'm not talking about an absolute  
17 number. I don't care whether it's  $10^{-4}$  or  $10^{-5}$  or  $10^{-6}$   
18 or  $10^{-7}$ . I'm looking for a systematic discussion,  
19 kind of in the same way as the seismic.

20 DR. BURNS: I just gave you my best shot,  
21 which was that --

22 MEMBER STETKAR: But in what I read, I  
23 mean.

24 DR. BURNS: Oh. Sorry.

25 MEMBER STETKAR: Was it submitted? I

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 couldn't find anything in what I read.

2 DR. BURNS: It's not in what was submitted  
3 in the RAI or in the submittal.

4 MEMBER STETKAR: Okay. Go on ahead and  
5 finish your presentation. I will attack it from the  
6 other direction.

7 DR. BURNS: Okay. So we were attempting  
8 to incorporate the changes that we have identified as  
9 part of the EPU implementation into the PRA model that  
10 we have upgraded to meet the standard.

11 And the risk profile changes associated  
12 with EPU implementation are manifested by changes in  
13 the initiating event frequency, the success criteria,  
14 changes in operating interface modeling, changes in  
15 systems and system reliability, and changes in  
16 sequence timing.

17 So we modified the initiating event  
18 frequency to reflect the potential for increased  
19 challenges due to reduced balance of plant margins and  
20 by increasing the initiating event frequency for  
21 turbine trip specifically.

22 There were slight changes in the system  
23 success criteria for RPVD pressurization, ATWS  
24 overpressure. And we also modified the number of SRV  
25 challenges based on the deterministic calculations we

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 did for EPU.

2 There was no significant impact associated  
3 with the hardware changes because the new equipment  
4 was replaced in kind with like equipment. However, we  
5 did modify the SRV probability based upon the  
6 increased number of cycles.

7 There were no changes to ECCS or diesel  
8 generators. There were no new accident sequences that  
9 we identified. One of the principal influences, as  
10 Dr. Wallis identified, was associated with the reduced  
11 time available for crew diagnosis and execution for  
12 the time-critical actions. And that was included in  
13 the revised human reliability analysis.

14 There was no significant impact due to the  
15 changes in HCTL or pressure suppression pressure. And  
16 the core melt progression times were reduced based on  
17 the deterministic calculations that we did, but there  
18 was no change in the LERF calculated as a result.

19 MEMBER STETKAR: Ed, let me just add one  
20 in passing. I hope you have a quick answer. You have  
21 a conditional loss of off-site power value given a  
22 plant trip.

23 DR. BURNS: Yes, yes.

24 MEMBER STETKAR: Why is a different value  
25 used for LOCA signals and non-LOCA signals?

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 DR. BURNS: I think there were --  
2 historically, what has happened is that there was a  
3 Brookhaven NUREG that identified a difference in the  
4 two values. And it was based on very sparse data. So  
5 it was somewhat questionable that that data supported  
6 that difference.

7 Subsequent to that, EPRI had an expert  
8 panel that was convened to look at the values that  
9 Brookhaven had come up with. And the EPRI expert  
10 panel identified that there was, in fact, a potential  
11 difference associated with the -- and it had to do  
12 with the loss of VARS and the feedback from the grid.  
13 But subsequent to that, the NRC also revised their  
14 numbers in a SECY document more consistent with the  
15 EPRI analysis.

16 Recently, though, 68.90, for example, has  
17 a single value in it, as opposed to the two values.

18 MEMBER STETKAR: Because the 68.90 is more  
19 derived from historical experience.

20 DR. BURNS: Right.

21 MEMBER STETKAR: I was just curious if  
22 there was any real -- I don't understand why there  
23 would be a factor-of-three difference.

24 DR. BURNS: The original issue arose  
25 because the theory was that for a LOCA or an event

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 that had a LOCA signal associated with it, that what  
2 you were doing was you were losing a plant and you  
3 were starting the large ECCS loads at the same time.  
4 That was the original theory. And that loading of the  
5 grid was supposed to -- that was the original theory.

6 MEMBER STETKAR: Okay. Thanks.

7 DR. BURNS: In summary, implementing this  
8 model changes gives the following quantitative  
9 results. For the change in CDF, we get 6.80 minus 7,  
10 which reg guide 1.174 characterizes as very small,  
11 which is the lowest risk significance category allowed  
12 in 1.174.

13 Similarly, the results for LERF. On the  
14 next two slides, I have this graphically displayed to  
15 --

16 DR. WALLIS: I would just like to make a  
17 point for the staff. I think the SER says that the  
18 change in CDF was 4.2 percent. It seems to me that  
19  $6.80 \text{ minus } 7 \text{ over } 9.4^{-6}$  is something over 7 percent.  
20 So the SER should reflect that, rather than the 4  
21 percent, which didn't seem to come from anywhere that  
22 I could find.

23 DR. BURNS: I think that's correct, yes.

24 These slides are just a graphic display of  
25 those quantitative results, which show that the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 position of the change in CDF and change in LERF  
2 associated with the EPU implementation places the risk  
3 in the risk region III, which is identified as a very  
4 small risk change.

5 So, finally, that's the LERF one. The  
6 next slide identifies the, the next slide, Vince,  
7 identifies the, risk assessment, provides confirmatory  
8 insights to those developed from a deterministic  
9 analysis. The risk impact was evaluated using  
10 standard PRA methods. And the quantified risk impact  
11 is a small percentage of the current plant risk.

12 DR. WALLIS: Let me ask you something.  
13 Did you do uncertainty analysis on this?

14 DR. BURNS: Of course, uncertainty can be  
15 divided into parametric uncertainty, modeling  
16 uncertainty, and completeness uncertainty. We did the  
17 parametric uncertainty analysis quantitatively and the  
18 modeling uncertainty analysis in a sensitivity  
19 calculation.

20 DR. WALLIS: Which uncertainty did you  
21 discover when you did that?

22 DR. BURNS: The range factor was a factor  
23 of three.

24 DR. WALLIS: Factor of three.

25 DR. BURNS: 2.9, I believe.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 DR. WALLIS: Factor of three on?

2 DR. BURNS: I'd have to look at the exact  
3 number.

4 DR. WALLIS: On CDF absolute value or  
5 change?

6 DR. BURNS: On the absolute value.

7 DR. WALLIS: So the change is less within  
8 the uncertainty? Yes?

9 DR. BURNS: Yes.

10 DR. WALLIS: Way within the uncertainty.

11 DR. BURNS: Yes.

12 DR. WALLIS: You are uncertain by a factor  
13 of three. And you are looking at a change of seven  
14 percent. Interesting.

15 DR. BURNS: In conclusion, the Hope Creek  
16 risk profile is appropriately characterized by the PRA  
17 consistent with the ASME PRA standard. And the  
18 quantified results reflect the very small risk impact  
19 associated with the EPU implementation.

20 Thank you very much for this opportunity.

21 DR. KRESS: Does your PRA have the  
22 capability for a full level 3 if you need it?

23 DR. BURNS: Currently the PRA for level 2  
24 only has large early release frequency, but we are --

25 DR. KRESS: No fission product transports?

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 DR. BURNS: We are undergoing an update  
2 right now which will convert it to full level 2, which  
3 will have the spectrum of radionuclide releases that  
4 can then feed into --

5 DR. KRESS: Into a MACCS.

6 DR. BURNS: Feed into MACCS, correct. And  
7 that should be done in June.

8 DR. KRESS: Do you plan on doing a level  
9 3?

10 DR. BURNS: We're preparing for a level 3  
11 in case there is a license extension submittal.

12 DR. WALLIS: I think you also did a  
13 qualitative shutdown risk evaluation?

14 DR. BURNS: Yes, sir.

15 DR. WALLIS: And that didn't lead to any  
16 surprises. You just had a little bit shorter time to  
17 do things because it boiled up quicker and so on?

18 DR. BURNS: Yes. Because the time is so  
19 long associated with the shutdown conditions, the  
20 delta in the human reliability analysis is extremely  
21 small.

22 DR. WALLIS: Do you have an estimate of  
23 how this shutdown risk compares with the internal  
24 events risk?

25 DR. BURNS: No, sir.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 DR. WALLIS: It could be comparable?

2 DR. BURNS: No, sir. We don't have a  
3 quantitative assessment for --

4 DR. WALLIS: No quantitative estimate. So  
5 we don't know what it is, but we know that it didn't  
6 change very much.

7 DR. BURNS: Yes, sir.

8 DR. WALLIS: Okay.

9 CHAIR ABDEL-KHALIK: Thank you, Mr. Burns.

10 At this time we will move on to  
11 presentation item number 21 on the agenda.

12 21. RISK EVALUATION

13 MR. HARRISON: Good afternoon. My name is  
14 Donald Harrison. I am with the Balance of Plant  
15 Branch now. And I was right with Marty Stutzke. He  
16 was the actual PRA reviewer for the Hope Creek  
17 application. I will also recognize that Mark Rubin's  
18 at the side table. He's the PRA Branch Chief.

19 What I am going to do is given that Dr.  
20 Burns presented the Hope Creek analysis, I am not  
21 going to repeat his analysis and describe that. I am  
22 just going to go into what the process of our review  
23 was, especially for some of the ACRS members that may  
24 be new members to the Committee. So, with that, we  
25 will start with the conclusion.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1                   This is not a risk-informed application.  
2                   And the submittal is looked at in a unique fashion if  
3                   it's not risk-informed.       And we are actually  
4                   evaluating the risk information.

5                   We are looking for what is called special  
6                   circumstances that would rebut the presumption of  
7                   adequate protection.   So the focus is on adequate  
8                   protection,   reasonable assurance of adequate  
9                   protection.

10                  In this review, we did not find any such  
11                  special circumstances.   We'll get into what it means  
12                  to have special circumstances and how we do our  
13                  review.

14                  And, again, this is a summary.   Hope Creek  
15                  is not risk-informed.   Therefore, it's not evaluated  
16                  by the staff against the SRP 19.2 or reg guide 1.174.  
17                  However, that guidance is used as, if you will, some  
18                  help in doing the review, help for the licensees in  
19                  actually making their submittal.

20                  The application is actually reviewed  
21                  against the review standard, 001, rev. 0, maybe a rev.  
22                  1 by now, -- I'm not sure -- Matrix 13, which is the  
23                  risk evaluation section.

24                  A review is done consistent with SRP  
25                  section 19.2, appendix D.   And that appendix is

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 specifically written for the use of risk information  
2 and reviews of non-risk-informed license amendments,  
3 which extended power uprates is one.

4 In doing that review, we determined that  
5 a special circumstance exists that, again, could rebut  
6 the presumption of adequate protection. In also doing  
7 that review, we also confirmed that the risk values  
8 are acceptably small.

9 Here are some definitions. Issues that  
10 could rebut the presumption of adequate protection.  
11 This becomes the definition of what is a special  
12 circumstance.

13 Within that appendix D, it provides two  
14 basic situations that you could be in that could  
15 result in that. One is if you identify an issue that  
16 wasn't addressed in the original writing of the  
17 regulations and the guidance. And it could be  
18 important enough that it would warrant rewriting the  
19 rules, rewriting the regulations to address this  
20 issue.

21 DR. WALLIS: Such as discovering that the  
22 steam dryer is risk-significant?

23 MR. HARRISON: The situation in that, what  
24 you do is if you found that that was a critical issue  
25 and it needed to go back and we had to rewrite the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 regulations, one way to look at that would be to go  
2 back and do that.

3           What has happened subsequent to the Quad  
4 Cities is, again, there are a number of different  
5 methods that have been addressed. You have heard  
6 extensively on the different methods and how the  
7 Deterministic Branch is addressing those issues so  
8 that we're not going into writing regulations. But  
9 you're right. That would be some type of  
10 consideration.

11           A typical example here would be if someone  
12 is using a material, a unique material, in an  
13 application that hadn't been thought of before. They  
14 meet the regulations. But with these material  
15 properties, we're not really sure what to do. I think  
16 that may have actually been the genesis of the special  
17 circumstance process in the first place back in the  
18 1990s.

19           The second one -- this is where most of  
20 our effort is spent -- is if the actual staff reviewer  
21 has knowledge that the risk impact is not being  
22 reflected in the licensing basis and that if it had  
23 been reflecting this, this had been risk-informed, we  
24 would have grounds to deny the application on the risk  
25 basis. And, again, this is what drives why the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

(202) 234-4433

[www.nealrgross.com](http://www.nealrgross.com)

1 applicant makes the submittal they make and why we  
2 spend most of our time.

3 You are not expected to be able to read  
4 this chart.

5 (Laughter.)

6 MR. HARRISON: Sorry. Just recognize on  
7 the right-hand side, there is --

8 DR. WALLIS: Not only is it expected.  
9 It's completely impossible.

10 MR. HARRISON: Well, on a white piece of  
11 paper, you can almost make it out. That's the  
12 background that gets you on that one.

13 This picture logic is actually in appendix  
14 D to section 19.2. So if you're more interested, you  
15 can actually go there and look at it. We are going to  
16 spend the next couple of viewgraphs actually walking  
17 through the first couple of diamonds in this plot.

18 What this is, this is the flow logic of  
19 how we do our review. You come in with an application  
20 that's not risk-informed. It's at the very top. The  
21 very first diamond says, "Do you have special  
22 circumstance?" If the answer is "No," "Did the staff  
23 identify it?" If the answer is "No," you would end up  
24 on this chart going to the right. And it says the  
25 application is acceptable. As you go through, you

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 will see at every diamond, if you go to the right, the  
2 application is acceptable.

3 If the staff identifies an issue that  
4 raises the topic of special circumstance, we don't  
5 just deny the application. What we then do is inform  
6 --

7 DR. WALLIS: You don't assess it against  
8 reg guide 1.174, but, yet, you do.

9 MR. HARRISON: Eventually. And you'll see  
10 that as we go through. And, again, at this level, we  
11 get the risk information from the applicant. We look  
12 at it. And, again, what we're looking at is, is there  
13 any issue that we are aware of that would make the  
14 risk much more significant than what is being  
15 portrayed and that would make it actually an  
16 unacceptable application.

17 DR. KRESS: Do the safety goals enter your  
18 review at all?

19 MR. HARRISON: Not directly. What we're  
20 doing is -- and, again, I am using the word "risk."  
21 What I am really meaning in our approach is core  
22 damage frequency and large early release frequency.  
23 So those were the surrogates for the actual QHOs and  
24 measures. So we do not do a --

25 DR. KRESS: So it is an indirect?

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. HARRISON: It is an indirect. It is  
2 not direct. It doesn't do a direct comparison.

3 That being said, the very first block,  
4 again, this is showing the logic here. The first  
5 diamond asks, you know, essentially, "Do you have an  
6 issue that could rebut the presumption of adequate  
7 protection?" In other words, do we think we have  
8 special circumstance?

9 If you go to the right, the application  
10 goes on. We terminate our review at that point. If  
11 we think we do, we go on down.

12 Now, just as a point -- and I think Bob  
13 Pettis said there have been 20 power uprates, extended  
14 power uprates. We have never gone through the yes  
15 part of this block on any extended power uprates that  
16 we have reviewed.

17 And, just as a point of reference, Marty  
18 and I have been the risk reviewers of every power  
19 uprate, extended power uprate, for about the last six  
20 years. So the two of us are kind of the ones that  
21 have been doing this process.

22 If you go through again the process and we  
23 find we have special circumstance, we notify our  
24 management. We also notify the licensee at that time.

25 And, just as an aside, if we did that, at

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 that point I think we would probably notify projects  
2 that the schedule has just been blown.

3 DR. WALLIS: Don, can I ask you something?  
4 When you seem to be just quoting the numbers quoting  
5 to you by the licensee, did you do some independent  
6 checks that what he did was reasonable?

7 MR. STUTZKE: If you want to jump ahead to  
8 the table of results, those numbers for independent  
9 fire and seismic are my estimates.

10 DR. WALLIS: They are your estimates?

11 MR. STUTZKE: Yes, sir, imperfect as they  
12 are.

13 DR. WALLIS: Well, then tell me --

14 DR. KRESS: Did you use the SPAR models  
15 for that?

16 MR. STUTZKE: No. I started with  
17 licensee's information from IPEEE, very simple.

18 DR. KRESS: I see.

19 DR. WALLIS: So the previous slide, where  
20 he estimates the change, internal events, you just  
21 accept as --

22 MR. STUTZKE: Yes.

23 DR. WALLIS: There is no reason not to, is  
24 there?

25 MR. STUTZKE: Based on the review.

1 MR. HARRISON: Well, we do a review. I  
2 mean, it's not that they send it to us and we just  
3 check off.

4 DR. WALLIS: Well, the question might be,  
5 did he evaluate his human error probability  
6 reasonably? Did he use some wild model for human  
7 error probability?

8 MR. HARRISON: Do you want me to? Marty  
9 during his review I know this is --

10 DR. WALLIS: Did you use EPRI model or  
11 something like that? What did you do?

12 MR. STUTZKE: Okay. So in order to do the  
13 review of the human reliability, I went to NUREG-1842,  
14 which is the so-called HRA good practices document.  
15 It's out. This is one of the first chances we have  
16 had to utilize the document. So you go down through  
17 all the points.

18 The idea of that document, you know we  
19 have a PRA standard, which tells you what you ought to  
20 do. This document tells you how you should go about  
21 doing it.

22 DR. WALLIS: How to do it, yes.

23 MR. STUTZKE: Okay? Specifically to the  
24 licensee here, they used two methods to quantify their  
25 HRA. They used either the cost-based decision tree

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 methods or ASEP. That's for the cognitive portion.

2 You wanted to use ASEP when you are  
3 time-limited, generally less than 60 minutes. It's  
4 what used to be called the time-reliability  
5 correlation curves. You pick off the available time  
6 without the probability of failure.

7 Cost-based decision tree looks at other  
8 sorts of shaping factors, procedures, training where  
9 the time is not driving that reliability. All of  
10 these methods were implemented in the EPRI HRA  
11 calculator. It's nothing more than a quantification  
12 tool.

13 DR. WALLIS: So you did check that he was  
14 using reasonable and approved methods.

15 MR. STUTZKE: Yes.

16 MR. HARRISON: And, just to clarify, the  
17 NRC has never approved an HRA method, but their --

18 DR. WALLIS: No. I think that's one of  
19 the matters for discussion in another subcommittee.

20 MR. HARRISON: Right. And I just want to  
21 clarify because you mentioned the word "approved."

22 DR. WALLIS: I'm sorry. Yes. You are  
23 right.

24 MR. HARRISON: We recognize the models.  
25 We are familiar with them --

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 DR. WALLIS: You accept without approval.

2 MR. HARRISON: We accept them, right.

3 DR. WALLIS: Yes.

4 MR. HARRISON: Just to clarify that. So  
5 okay. And since Marty got us here, actually, for the  
6 internal events results, the information is the same  
7 as what the licensee provided.

8 I think I made the big deal a few years  
9 ago to only present these as single significant  
10 digits. So we'll round it off from where the licensee  
11 provided the information.

12 So, again, the internal fires and seismic  
13 events Marty discussed, we can move on to --

14 MEMBER STETKAR: Yes. Let me stop you  
15 there.

16 MR. HARRISON: Okay.

17 MEMBER STETKAR: I saw what you did. And  
18 it's -- well, I'll be not tactful. It's not  
19 technically justified. It's an absurd calculation.  
20 And it should not be published in the SER, period.

21 DR. KRESS: You weren't very tactful, were  
22 you?

23 MEMBER STETKAR: I said I wouldn't be  
24 tactful.

25 DR. WALLIS: This is the first endorsement

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 I've heard in a long time.

2 (Laughter.)

3 MEMBER STETKAR: So I don't particularly  
4 want to understand the basis for it because there is  
5 no technical basis. Taking the average change in the  
6 average internal event core damage frequency and  
7 ratio-ing it twice and saying that it has any  
8 relevance to the fire-initiated core damage frequency  
9 that's dominated by specific combinations of  
10 initiating events and equipment failures just doesn't  
11 make any sense at all.

12 If you had gone through, if you or the  
13 licensee had gone through, a systematic evaluation of  
14 those top 95 percent scenarios and said, "Okay. If  
15 this scenario, fire scenario, is modeled as a loss of  
16 off-site power or an MSIV closure and let's look at  
17 the change in that kind of contribution and scale it  
18 according to the type of event that it looks like," I  
19 might have been more convinced.

20 But to come up with a number that says the  
21 change from pre-EPU to post-EPU from the internal fire  
22 risk is  $1E^{-6}$  has absolutely no basis at all. I have  
23 no confidence that that number -- I mean, it could be  
24  $5E^{-6}$ . It could be  $1E^{-8}$ . There's just no technical  
25 basis for it at all.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1                   And I don't know if that type of analysis  
2 or calculation has been done in previous EPU  
3 submittals. And I don't have that background, but it  
4 should stop now if I could be pretty blunt.

5                   Not only is it not technically justified.  
6 It gives the wrong message toe potential future  
7 applicants to say that that type of application would  
8 be accepted if it were performed.

9                   DR. WALLIS: It's not conservative or  
10 anything like that.

11                   MEMBER STETKAR: It's not. It's not.

12                   DR. WALLIS: No.

13                   MEMBER STETKAR: You can't characterize it  
14 as approximate or conservative or anything. It's just  
15 --

16                   DR. WALLIS: Wrong.

17                   MEMBER STETKAR: It's just wrong.

18                   MR. HARRISON: We will take that comment  
19 and go back and fix it.

20                   MEMBER STETKAR: And the same applies also  
21 for the couple of scenarios where you did the same  
22 type of ratio-ing on the seismic, the ones that didn't  
23 just pass through from guaranteed failure, because of  
24 the five or six seismic scenarios, you apparently did  
25 the same type of numerical ratio-ing if I read the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 words right.

2 DR. KRESS: Did you look at shutdown risk?

3 MR. STUTZKE: It was qualitative.

4 MR. HARRISON: It is a qualitative  
5 approach. It's typical --

6 DR. KRESS: Normally an increase in power  
7 affects the shutdown more than normal risk, doesn't  
8 it?

9 MR. HARRISON: There is the decay heat and  
10 issues that would be reflected in shutdown risk that,  
11 again, it's done qualitatively by the licensee to  
12 address the time extensions that occur and then  
13 alternate feed capability gets pushed out. But,  
14 again, as I reflected, it's a number of hours later.  
15 It's not --

16 DR. KRESS: It's not some --

17 MR. HARRISON: It's not near-term.

18 MEMBER STETKAR: Yes. Typically as long  
19 as you don't change fundamental success criteria, like  
20 requiring RHR loops early on or something like that,  
21 as long as the fundamental hardware success criteria  
22 is staying the same, the time windows are typically  
23 long enough that the delta in the time usually isn't  
24 too relevant.

25 MR. HARRISON: Well, again, that was done

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 qualitatively. We have always evaluated those. I  
2 don't want to say always, but the vast majority of our  
3 reviews have always been qualitative reviews in that  
4 area.

5 With that, why don't we jump to the  
6 conclusions? The staff concluded that the licensee  
7 had accurately modeled. Again, they talked about  
8 their self-assessment against the standard as well and  
9 that they have addressed the potential risk impacts  
10 associated with it.

11 The majority of their identified impacts  
12 in this application are typical of what we see in  
13 power uprates that do a 15-20 percent uprate.

14 The risks are acceptable. They meet what  
15 would be our reg guide 1.174 risk acceptance  
16 guidelines if it had been risk-informed. And, with  
17 that, we conclude that we could not identify any  
18 special circumstances that would rebut the presumption  
19 of adequate protection provided by meeting the  
20 deterministic review criteria.

21 With that, I'm open to any other  
22 questions.

23 CHAIR ABDEL-KHALIK: Any other questions?

24 (No response.)

25 CHAIR ABDEL-KHALIK: Thank you, gentlemen.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 Move on to item 22.

2 22. MATERIALS AND CHEMICAL ENGINEERING

3 MR. MITCHELL: Good afternoon. I'm  
4 Matthew Mitchell, Chief of the Vessels and Internals  
5 Integrity Branch in NRR. I'm sitting in this  
6 afternoon for my reviewer of the Hope Creek EPU to  
7 talk about the specific topic of reactor vessel  
8 integrity.

9 For the benefit of the newer members of  
10 the Committee, I will just briefly review the fact  
11 that the applicable regulations for a BWR like Hope  
12 Creek in the area of reactor vessel integrity are  
13 CFR Part 50, appendices G and H.

14 Appendix G addresses the need to establish  
15 reactor pressure vessel, pressure temperature limits,  
16 and sets limits for upper shelf energy, for reactor  
17 vessel beltline materials. And appendix H addresses  
18 the need to establish a reactor pressure vessel  
19 material surveillance program monitoring changes and  
20 material properties.

21 I will go right to summarizing the results  
22 of our review of the Hope Creek submittal. First is  
23 that the reactor pressure vessel surveillance program  
24 proposed by the licensee continues to comply with the  
25 guidance and structure provided in the BWR vessels and

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

(202) 234-4433

www.nealgross.com

1       internals project integrated surveillance program,  
2       which the licensee is already implementing.

3               There's a small change to the proposed  
4       withdrawal date. I believe it moves from 22 to 23  
5       effective full-power years for the next Hope Creek  
6       surveillance capsule. But with that small  
7       modification, it would continue to support the  
8       licensee's compliance with appendix H.

9               With regard to pressure temperature  
10       limits, the existing Hope Creek pressure temperature  
11       limits continue to remain valid. The analysis upon  
12       which those P-T limits were set up back in 2004 were  
13       actually already incorporated considerations of a  
14       future EPU. Hence, we merely confirmed the facts at  
15       the adjusted reference temperature for the limiting  
16       material remained the same and that, therefore, the  
17       P-T limits remained valid.

18               With regard to the upper shelf energy  
19       analysis, both the limiting beltline plate and weld  
20       remained above the 50-foot pound screening limit  
21       established in appendix G and are, therefore,  
22       acceptable.

23               MR. YODER: All right. I am Matt Yoder  
24       from the Chemical Engineering Branch. I'm going to  
25       talk about protective coatings for accelerated

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 corrosion, reactor water cleanup system.

2 I've provided you with the regulatory  
3 framework for each of these areas. Unless there is no  
4 objection, I will skip over that and go right into the  
5 technical review.

6 Next slide. For protective coatings --

7 DR. WALLIS: Does pressure uprate have  
8 anything to do with coating?

9 MR. YODER: It doesn't. That's what I'm  
10 about to say.

11 (Laughter.)

12 MR. YODER: Well, what we're concerned  
13 with is the coatings are qualified in an autoclave to  
14 withstand temperature pressure and radiation. There  
15 is a slight increase of each of those things. The  
16 bottom line is that the original qualification still  
17 bounds the coatings.

18 Next slide. Next. For flow-accelerated  
19 corrosion, there is an impact. Obviously some  
20 components in some systems are going to see an  
21 increase in the wear rate. This is due primarily to  
22 the velocity.

23 DR. WALLIS: These are not  
24 safety-significant components, are they?

25 MR. YODER: Some of them are.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 DR. WALLIS: Some of them are? Okay. But  
2 the wear rates there are very small, aren't they?

3 MR. YODER: As a result of EPU, I think  
4 the most susceptible systems saw between a 10 to 25  
5 percent increase in the wear rate.

6 DR. WALLIS: That's way up in the  
7 feedwater heaters and things like that, isn't it?

8 MR. YODER: Yes. The most susceptible  
9 systems, yes, the feedwater heater drains and sealed  
10 steam systems.

11 CHAIR ABDEL-KHALIK: Please continue.

12 MR. YODER: Okay. The licensee put in the  
13 new parameters for velocity temperature flow into  
14 their predictive model, determined what the most  
15 susceptible systems would be and, as I said, what the  
16 wear rates would be for those systems. As a result of  
17 that, some components were added in as additional  
18 monitoring points to the existing CHECWORKS model to  
19 predict wear rates.

20 Next.

21 MEMBER STETKAR: Let me stop you there  
22 since it's flow-accelerated corrosion. It might be a  
23 PRA question, but somewhere -- and it wasn't the PRA  
24 section -- said that they did a sensitivity study to  
25 account for the possible effects of flow-accelerated

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 corrosion by doubling the large LOCA initiating event  
2 frequency. And by doing that, the core damage  
3 frequency increased by 2.3 percent.

4 Any idea what would happen if you doubled  
5 the small LOCA initiating event frequency, what effect  
6 that would have on a delta CDF, this sensitivity study  
7 to account for the possible risk impacts from  
8 increased flow-accelerated corrosion?

9 MS. KUGLER: Could you repeat the  
10 question?

11 MEMBER STETKAR: Yes. The question was,  
12 in a risk assessment, a sensitivity study was  
13 performed to look at the potential impact from  
14 flow-accelerated corrosion by doubling the large LOCA  
15 initiating event frequency. And the result of that  
16 increased core damage frequency by a little more than  
17 two percent.

18 The question was, do you have any idea  
19 what would the core damage frequency impact be if you  
20 doubled not the large LOCA frequency but the small  
21 LOCA frequency because flow-accelerated corrosion  
22 could indeed affect -- there's no reason to believe  
23 it's necessarily going to cause a large LOCA. It  
24 could cause a small LOCA.

25 DR. BURNS: Would you like me to address

1 that? Ed Burns. Okay.

2 I would look at the turbine trip frequency  
3 change that we did. We doubled the turbine trip  
4 frequency. And that came out to be around 1 or 2  
5 times  $10^{-6}$ . That would give you a pretty good idea of  
6 what you would do if you --

7 MEMBER STETKAR: Turbine trip model take  
8 credit for feedwater and condensate?

9 DR. BURNS: Yes.

10 MEMBER STETKAR: Okay.

11 DR. BURNS: And we would do that for --

12 MEMBER STETKAR: For small LOCA.

13 DR. BURNS: For small LOCA, we would use  
14 the condensate system after the MSIVs went closed.

15 MEMBER STETKAR: And what was the  
16 increase?

17 DR. BURNS: For the doubling of the  
18 turbine trip?

19 MEMBER STETKAR: Yes.

20 DR. BURNS: It was around one to two times  
21  $10^{-6}$ . So if you go to the small LOCA frequency and  
22 double that, you could back that out.

23 MEMBER STETKAR: Thank you.

24 DR. BURNS: Sure.

25 MR. YODER: Okay. Reactor water cleanup

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 system is the last system I will talk about. There  
2 are some changes to the operating temperature and  
3 pressure. Those remain within the design limits of  
4 the system. And these are what I consider very  
5 insignificant changes.

6 DR. WALLIS: Isn't this the one which gave  
7 rise to a bigger mass loss if it broke or something?  
8 There was one mysterious place. I think this was the  
9 one. What was it? They changed the pipe size.

10 MEMBER STETKAR: But what we see now, they  
11 --

12 DR. WALLIS: I thought I read that the  
13 mass release for breaks on the reactor water cleanup  
14 system piping will increase by 36 percent. I didn't  
15 understand that.

16 MR. DUKE: This is Paul Duke.

17 That's correct. Actually, the increase is  
18 due to the change in conditions at the break location.  
19 We changed our conditions for evaluation to assume  
20 that the break would occur at the MELLLA minimum flow  
21 point.

22 So you would have actually higher break  
23 flow just by virtue of the fact that you had  
24 additional subcooling at the break location. That  
25 applies with or without EPU.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 DR. WALLIS: Right. This is not an EPU  
2 effect.

3 MR. DUKE: That's correct, but it was  
4 reevaluated for EPU.

5 DR. WALLIS: Thank you.

6 MR. YODER: The other impact of EPU is  
7 that you will have additional impurities, principally  
8 iron, coming in from the feedwater that the reactor  
9 water cleanup system will have to handle. And, again,  
10 that remains within the system's capabilities.

11 CHAIR ABDEL-KHALIK: I think the applicant  
12 indicated that the reactor vessel at Hope Creek is the  
13 only Hitachi vessel amongst the BWR fleet. Has that  
14 presented any special or unique questions in your  
15 review of the reactor vessel?

16 MR. MITCHELL: The answer to your first  
17 statement is that's correct. I do believe Hope Creek  
18 owns the only Hitachi vessel, but no. In general, the  
19 materials from which reactor vessels have been  
20 fabricated for the entire fleet, not only the B's, but  
21 the PWRs are very similar in terms of the material  
22 specifications.

23 So they are very common and very  
24 comparable, although they may have been manufactured  
25 by different vendors: Chicago Bridge and Iron,

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 Combustion Engineering, Hitachi. The material specs  
2 are always very close to one another.

3 So the information we have gotten from  
4 multiple vessels is comparable from one to the other.

5 DR. WALLIS: So the other like PWR vessel  
6 heads, there seems to be quite a variation,  
7 susceptibility?

8 MR. MITCHELL: No, not on the items that  
9 are of principal interest from an RPV integrity  
10 standpoint on initial RTNDT copper nickel. They're  
11 well-defined.

12 MEMBER MAYNARD: I meant to ask this when  
13 the applicant was up there. I'm not for sure it is  
14 more appropriate for staff or the applicant. That's  
15 the only one in the U.S., but are there Hitachi  
16 vessels outside the U.S.? And are you getting any  
17 operating experience or information relative to those  
18 if they are?

19 MR. DAVISON: This is Paul Davison. The  
20 answer is yes. There are other Hitachi vessels  
21 overseas, outside the United States. They are not  
22 part of the ISP program, however. So the operational  
23 experience that we get from them does not come through  
24 that channel, however, does exist. And we do ensure  
25 that we incorporate operating experience in our

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

(202) 234-4433

[www.nealgross.com](http://www.nealgross.com)

1 program.

2 MEMBER MAYNARD: Okay.

3 DR. WALLIS: GE and Hitachi are not  
4 together. So you could get information through --

5 MEMBER MAYNARD: I meant to clarify that  
6 earlier because you talked about them not being in the  
7 program, but that doesn't mean the data that -- that's  
8 good.

9 CHAIR ABDEL-KHALIK: Thank you. We'll  
10 move on to item 23, presentation by the applicant on  
11 electrical and grid reliability. And I promise that  
12 we'll take a break after that presentation.

13 DR. WALLIS: We are almost at the end,  
14 aren't we?

15 23. ELECTRICAL AND GRID RELIABILITY

16 MR. DAVISON: Good afternoon. I am Paul  
17 Davison. With me is Brandon Swarley from the Hope  
18 Creek Electrical Design Group. And we will be discuss  
19 the electrical and grid reliability on page 41.

20 Hope Creek operates in the Pennsylvania,  
21 New Jersey, Maryland, or PJM, interconnection  
22 territory. As required by PJM, Hope Creek filed the  
23 Federal Energy Regulatory Commission, or FERC,  
24 approved regional transmission expansion planning  
25 process and performed studies in accordance with the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 FERC-docketed interconnection service agreement for  
2 the power uprate and its effect on the grid.

3 Feasibility was conducted and included  
4 short-circuit end flow analysis. And the system  
5 impact included a comprehensive regional analysis that  
6 included stability assessments for single and multiple  
7 facility contingencies.

8 Finally, the generation interconnection  
9 facility study was performed to assess detailed  
10 artificial island operating strategies. The studies  
11 are docketed in the RTEP, or regional transmission  
12 expansion planning, keys, H18 and H19, and serve as  
13 input to that living database for other active  
14 transmission and generation studies. This prevents  
15 invalidation of our studies while we await  
16 implementation of EPU.

17 Next slide. All studies showed that there  
18 were no problems at EPU conditions with the exception  
19 of the system impact study, which violated the  
20 Mid-Atlantic Area Council criteria number IV. The  
21 study revealed that a single line to ground fault on  
22 the red line 500 kV line at Hope Creek where the  
23 number 3-4 breaker does not trip, would result in  
24 Salem-Hope Creek units becoming unstable and  
25 potentially tripping.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

(202) 234-4433

[www.nealgross.com](http://www.nealgross.com)

1 DR. WALLIS: This has nothing to do with  
2 EPU, does it? This has nothing to do with EPU?

3 MR. DAVISON: Increased power output of  
4 the station.

5 DR. WALLIS: It causes this to be  
6 unstable?

7 MR. DAVISON: Yes.

8 DR. WALLIS: It wasn't unstable before.

9 MR. SWARLEY: Increased inertia on the  
10 machine.

11 DR. WALLIS: Enough to make it unstable?

12 MR. SWARLEY: Increased output in the  
13 system model changes, too, into the configuration.

14 DR. WALLIS: What sort of a system model  
15 is this?

16 MR. SWARLEY: It is a transient stability  
17 model. So this is a model in the PSSA program by PTI.

18 DR. WALLIS: It's not your own model?

19 MR. SWARLEY: No. This is owned by the  
20 regional transmission company, PJM. It's actually a  
21 model developed by all the members and input to PJM.  
22 PJM uses this for the 1,200 and some generating  
23 sources they have within their area.

24 DR. WALLIS: Do you input your own plant  
25 models?

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. SWARLEY: Yes.

2 DR. WALLIS: It takes into account inertia  
3 and things like that?

4 MR. SWARLEY: Yes. And we provide them --

5 DR. WALLIS: So this red-line effect has  
6 nothing to do with the red-line effect which is in my  
7 book?

8 MR. DAVISON: LIN.

9 DR. WALLIS: Oh, I'm sure it doesn't. You  
10 won't understand the reference.

11 MEMBER SIEBER: It seems to me as this is  
12 not an EPU issue. To me it is written out on the  
13 slide as a current issue.

14 CHAIR ABDEL-KHALIK: A current issue?

15 MEMBER SIEBER: Yes. You have a stuck  
16 breaker 60X, that's the stability issue is there,  
17 whether you increase the plant output or not, right?

18 MR. SWARLEY: By increasing the plant  
19 output put us closer to the stability limits.

20 MR. DAVISON: The question is, if we were  
21 to have the fault today before EPU, would this same  
22 condition requiring a break or addition be present?

23 DR. WALLIS: And the question I asked as  
24 well?

25 MEMBER ARMIJO: Yes.

1 MR. SWARLEY: Since we have increased the  
2 machine inertia or changed that inertia, now that we  
3 have our extra breaker in the system, we wouldn't have  
4 that situation now.

5 MEMBER SIEBER: Yes. This will solve the  
6 problem. Well, we are reviewing EPU, not today's  
7 operations.

8 MEMBER MAYNARD: It is potentially an EPU.  
9 It really depends on, did this increase in power put  
10 you over the margin there, too much of the margin? I  
11 think you were initially saying, yes, it did.

12 I'm not getting a high level of confidence  
13 that that's the case. I think this takes care of the  
14 problem either way, but --

15 DR. WALLIS: The answer to Jack's question  
16 is different from the answer to mine. Then I am  
17 confused.

18 MR. SWARLEY: The stability case analyzed  
19 for EPU is we increased the machine output  
20 significantly. We went up to 1320 for our EPU model  
21 for the PJM. We also changed our machine inertia.

22 When they redid the study, they looked at  
23 many different fault scenarios. And they came up with  
24 one where they said if we have a single line to ground  
25 with a stuck breaker, we should include this new

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 breaker.

2 MEMBER MAYNARD: I understand that for the  
3 EPU conditions. That same analysis at current license  
4 level conditions, would you still be exceeding that,  
5 getting into the stability issues?

6 DR. WALLIS: The inertia doesn't show.

7 MR. SWARLEY: I don't believe so because  
8 we would be operating at a lower power. And the power  
9 has to do with coming closer to the stability limit.

10 MEMBER SIEBER: The real key question is,  
11 when do you plan to change or add the circuit breaker?

12 MR. DAVISON: That was already done  
13 several years ago.

14 On page 43, there is a schematic pictorial  
15 of our previous discussion. The 62X breaker that is  
16 depicted in red is located between the 60X and the  
17 number 2 bus. So the single phase line to ground  
18 fault is shown also in red.

19 This fault in conjunction with the delayed  
20 breaker trip of the 60X would result in that Mach  
21 criteria IV violation, hence the addition of that 62X  
22 breaker that was done several years ago.

23 Page 44. The artificial island operating  
24 guide for EPU and exists now covers various operating  
25 scenarios, which operations follow for dispatch

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 decisions. They include multiple unit operating  
2 combinations; Salem-Hope Creek power system  
3 stabilizers being in or out of service, which is  
4 associated with more precise generator voltage  
5 regulation; and the Salem trip-a-unit scheme, enabled  
6 or disabled, that results in the trip of a Salem unit  
7 during transmission line loss.

8 The purpose of the operating guide is to  
9 ensure that minimum required reactive power is  
10 available to maintain grid stability following the  
11 analyzed contingency implementation via a real-time  
12 analysis tool. The real-time analysis also enjoys its  
13 situations that could result in off-site source  
14 inoperability for the GDC requirements are  
15 communicated to operations personnel to take  
16 appropriate action.

17 On page 45, in conclusion, the increased  
18 power output attributed to the Hope Creek EPU was  
19 assessed in accordance with the PJM planning process  
20 to ensure that the grid stability and station off-site  
21 power source reliability remains at all times.

22 End of presentation. If you have any  
23 questions?

24 CHAIR ABDEL-KHALIK: Any questions for Mr.  
25 Davison?

1 MEMBER BANERJEE: Did the staff have to  
2 review this or they are going to come back to us,  
3 right?

4 CHAIR ABDEL-KHALIK: Yes, yes. Thank you.

5 MR. DAVISON: Thank you.

6 CHAIR ABDEL-KHALIK: At this time we will  
7 take a break, 15 minutes. We will be back at 4:35.

8 (Whereupon, the foregoing matter went off  
9 the record at 4:18 p.m. and went back on  
10 the record at 4:32 p.m.)

11 CHAIR ABDEL-KHALIK: We are back in  
12 session. Before we get started with presentation  
13 number 24, the applicant would like to provide some  
14 information regarding information that had been  
15 requested earlier.

16 MR. DAVISON: Yes. Thank you. Paul  
17 Davison from PSEG.

18 I have two follow-up items from earlier  
19 conversations. During my discussion on vessel  
20 internals, I was talking about the jet pump sensing  
21 lines, the finite element analysis, and the hammer  
22 testing that we did. The question was, what were the  
23 natural frequencies of the sensing lines inside the  
24 vessel?

25 There are two modes: one at 50 hertz,

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 approximately 50 hertz; and the second at 150 hertz.  
2 In fact, the reason for the clamp that was installed  
3 on jet pump sensing line number 11 was due to its  
4 natural resonance frequency being very close to the  
5 vane base frequency of the reactor research pump.

6 Second follow-up is to several questions  
7 associated with the moisture carryover testing. I  
8 will take them one at a time. There was a question  
9 regarding the sodium source. That's naturally  
10 occurring in our groundwater, sodium-23. Our  
11 demineralized water plant removes most but not all of  
12 the sodium-23. Therefore, the sodium-23 is changed  
13 into sodium-24 in the reactor.

14 Sodium-24 has a half-life of approximately  
15 15 hours. It is only carried over in the water  
16 content of the steam flow. Therefore, there is a --

17 DR. WALLIS: Excuse me. Fifteen-hour  
18 half-life? How does it exist? It must be formed on  
19 something else all the time.

20 MR. DAVISON: Continuous, correct.

21 DR. WALLIS: If it ever just existed by  
22 itself, it would --

23 MEMBER BANERJEE: The cross-section isn't  
24 that high.

25 MR. DAVISON: Correct.

1 DR. WALLIS: But you say it came in your  
2 groundwater?

3 MR. DAVISON: Correct, our water that we  
4 use to make demin.

5 DR. WALLIS: And the groundwater is making  
6 it all the time?

7 MR. DAVISON: Correct.

8 DR. WALLIS: What's making it? Leakage  
9 from the plant? You're leaking stuff into the ground  
10 and then using it in your groundwater as a tracer?

11 MR. DAVISON: No, no.

12 (Laughter.)

13 MR. DAVISON: We've done tritium testing.

14 DR. WALLIS: It has a 15-hour half-life.  
15 So the only reason it exists is if it is made from  
16 something else with a much longer half-life.

17 MEMBER BANERJEE: Sodium-23.

18 DR. WALLIS: So it must be made from  
19 something with a much longer half-life.

20 MEMBER BANERJEE: Sodium-23.

21 DR. WALLIS: It has a much longer  
22 half-life. That's why it's there. I'm sorry. I  
23 didn't hear it. So sodium-23. Okay.

24 MR. DAVISON: Okay. So our actual testing  
25 that we do on this is between the reactor water,

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 comparing the content between the reactor water and  
2 the actual water in the condenser.

3 So we do take samples from the reactor, be  
4 it reactor water cleanup system, as well as the  
5 condenser hotwell via the condensate demineralizer  
6 inlet or influent and do radiochemistry testing on it.

7 As far as how do we compare to the  
8 industry, we are very similar to plants like Peach  
9 Bottom and Clinton that un in the .003 to .005 range.  
10 We are lower than other plants --

11 DR. WALLIS: So that is percent? That is  
12 percent?

13 MR. DAVISON: Percent. We are lower than  
14 other stations, like Limerick, Dresden, LaSalle and  
15 Quad Cities, that run in the .01 to .05 percent range  
16 and much lower than Oyster Creek that is at .1643  
17 percent, just to give you a range of the different  
18 sets of plants that are out there.

19 DR. WALLIS: And then you said that you  
20 would stop if it went up by 50 percent in your  
21 ascension? Is that right?

22 MR. DAVISON: Okay. With respect to our  
23 predictions, our prediction is .03 at EPU. This is  
24 based on some initial GE analysis and factoring in the  
25 six-fold increase that we have seen at a plant like

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 Vermont Yankee.

2 DR. WALLIS: It goes up by a factor of six  
3 just for that power increase.

4 MR. DAVISON: Well, that is our estimate.  
5 However, because our moisture carryover is so low and  
6 there is such a wide variation in the industry data,  
7 we continue to use the .1 as our level II, which is  
8 our stop-and-analyze.

9 DR. WALLIS: Well, you make it something  
10 which is a little difficult to interpret. I mean, you  
11 may find that it goes up to .06 or something like  
12 that. And you say, "Well, we didn't expect it to up  
13 so much, but it's still less than .1. What should we  
14 do?"

15 MR. DAVISON: Correct. And that is the  
16 value of the trending that we're going to be using  
17 that with because we can take the trend of moisture  
18 carryover with respect to our power increase --

19 DR. WALLIS: Right.

20 MR. DAVISON: -- and use that to compare  
21 it with the changes we're seeing in the main steam  
22 line accelerometers and also the main steam line  
23 strain gages. So we have three different sets of data  
24 or ways to look at it to make a determination or  
25 evaluation if there is an adverse trend or something

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 that is not understood.

2 DR. WALLIS: The trend is steeper than you  
3 thought as well. Yes.

4 MR. DAVISON: Correct.

5 CHAIR ABDEL-KHALIK: Your level II for  
6 this says, "Moisture carryover exceeds .1 percent" --

7 MR. DAVISON: That is correct.

8 CHAIR ABDEL-KHALIK: -- or "Moisture  
9 carryover exceeds .1 percent and increases by greater  
10 than 50 percent over the average of the 3 previous  
11 measurements taken at greater than," et cetera.

12 Isn't one a subset of the other?

13 MR. DAVISON: Well, the reason if we  
14 exceed .1 and we understand and analyze that to be  
15 acceptable, we don't want to have no other acceptance  
16 criteria before we meet the level I or the .3 percent.  
17 So what we then say is if we're above .1, we're going  
18 to be looking for that 50 percent change that you  
19 mentioned.

20 DR. WALLIS: You have to get above .1  
21 first?

22 MR. DAVISON: That is correct. First is  
23 .1. And then after that, it would be 50 percent  
24 changes that would be triggering.

25 DR. WALLIS: From .005 to .1. That's

1 pretty significant by itself.

2 MR. DAVISON: Correct. And that would be  
3 analyzed and compared to the other two data sets that  
4 I mentioned.

5 DR. WALLIS: Thank you.

6 MR. DAVISON: Thank you.

7 CHAIR ABDEL-KHALIK: There was a third  
8 question regarding the uncertainty.

9 MR. DAVISON: Yes. Thank you. I am  
10 sorry.

11 The average value, our calculation via the  
12 radiolytical testing, radiochemistry testing is  
13 .005871. We have a standard deviation of .001233 for  
14 significant digits.

15 But the gamma spectroscopy values are plus  
16 or minus 30 percent based on our analytical data in  
17 our chemistry lab on site. And that's done in  
18 accordance with GE SIL-644 recommendations.

19 DR. WALLIS: Ever due to just not having  
20 enough sample, statistical thing or is it something  
21 else?

22 MEMBER BANERJEE: It must be a counterage  
23 issue, right?

24 DR. WALLIS: The counter?

25 MEMBER BANERJEE: It's germanium crystal,

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 I take it, right?

2 MR. DAVISON: I don't know what type it  
3 is. That was the accuracy provided by our Chemistry  
4 Department with respect to our --

5 DR. WALLIS: You would have to have a big  
6 enough sample to get anything significant. Count  
7 forever.

8 CHAIR ABDEL-KHALIK: We will now proceed  
9 with the staff's presentation, item number 24.

10 24. ELECTRICAL AND I & C

11 MR. McCONNELL: Good afternoon. My name  
12 is Matthew McConnell. I am an electrical engineer in  
13 NRR. My branch was tasked with reviewing the  
14 electrical systems portion of the Hope Creek  
15 generating station's power uprate request. And I was  
16 one of the principal reviewers of that application.  
17 Sheila Ray, to my right, was also a reviewer.

18 Next slide. We reviewed the uprate  
19 application against regulations governing  
20 environmental qualifications, station blackout, and  
21 electrical power systems. Specifically, we reviewed  
22 the application to ensure that the existing  
23 environmental qualification classifications remain  
24 valid, that the loading on the safety equipment will  
25 remain bonding and that Hope Creek generating station

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

(202) 234-4433

www.nealgross.com

1 would continually operate safely under increased  
2 electrical output and increased plant load.

3 We also reviewed the results of the grid  
4 stability study that was provided in the Hope Creek  
5 power uprate application. PJM, the regional  
6 transmission organization for Hope Creek generating  
7 station performed the grid stability study for the  
8 proposed power uprate.

9 After reviewing the grid stability study  
10 results, we found that the grid stability study  
11 demonstrated that the power system and stable for all  
12 three phase and single phase failed study and, two,  
13 under all power flow conditions tested that the  
14 station and transmission systems satisfied the  
15 regional coordinator's reliability principals and  
16 standards; three, the tripping of the Hope Creek  
17 generating station will not have detrimental effects  
18 on grid stability; and, finally, that the artificial  
19 island bus remains stable and available.

20 Next slide, please. Licensee identified  
21 multiple components that would be impacted by the  
22 proposed power uprate. The licensee addressed these  
23 items by either upgrading or replacing these systems  
24 and/or components.

25 Specifically, the licensee made the

1 following modifications to support operation at power  
2 uprate conditions. The licensee divided the iso-phase  
3 bus stack into sections of modified bus stack cooling  
4 to remove the bus duct heat. Furthermore, the  
5 licensee added new main bank transformers and upgraded  
6 the main generator stator cooling.

7 Licensee also added a new 500 kV, I as  
8 mentioned earlier, breaker to provide backup clearing  
9 in the event of a stuck breaker. Licensee contended  
10 and the staff concurred that this would improve system  
11 stability. Finally, the staff verified that the  
12 existing protective relaying remained adequate.

13 Based on our review, we found that the  
14 Hope Creek generating station will continue to meet  
15 the regulations for environmental qualifications,  
16 station blackout, and electrical power systems while  
17 operating at power uprate conditions.

18 That concludes my presentation.

19 MEMBER STETKAR: Unfortunately, I have to  
20 ask you a question. DC systems, in the discussion of  
21 the DC systems, the observation was made that EPU  
22 conditions would not increase any equipment's duty  
23 cycle.

24 I know analyses were done to show that,  
25 for example, depending on the type of transient, you

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 could get something on the order of 13 percent more  
2 SRV cycles.

3 I asked the question earlier and didn't  
4 get an answer about number of HPIC and RCIC cycles.  
5 Those changes, if, indeed, there are additional  
6 HPIC/RCIC cycles would seem to impose additional loads  
7 on the station batteries. Did you look at that?

8 MR. McCONNELL: No, we did not.

9 MEMBER STETKAR: Why?

10 MR. McCONNELL: Because part of our  
11 application or review was centered around the fact  
12 that they had no increased loading expectations and  
13 did not provide any additional information to allude  
14 to the fact that there would be any additional loads  
15 on the DC system.

16 MEMBER SIEBER: There aren't, but there is  
17 capacity difference.

18 MR. McCONNELL: Absolutely. There would  
19 be a capacity difference if you were to --

20 MEMBER STETKAR: Well, yes. And the  
21 statement was made there wouldn't be any more duty  
22 cycles, which would affect capacity.

23 MR. McCONNELL: Well, duty cycle. Let's  
24 go back and refer, the duty cycle, where the battery  
25 is when you are recovering the overall load of the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 duty cycle, which would actually be something that  
2 would be testing on a normal basis through your  
3 service discharge test, which is a typical test. But  
4 it doesn't necessarily represent how many cycles the  
5 batteries --

6 MEMBER STETKAR: Ampere-hours are  
7 ampere-hours.

8 MR. McCONNELL: Right.

9 MEMBER STETKAR: And if you draw more amps  
10 from a battery, you have less power.

11 MR. McCONNELL: Absolutely.

12 MEMBER STETKAR: And starting equipment  
13 draws more amps.

14 MR. McCONNELL: Right.

15 MEMBER STETKAR: Starting more equipment  
16 more frequently draws more amps, which is more  
17 ampere-hours load.

18 MR. McCONNELL: Right.

19 MEMBER STETKAR: So my question is, did  
20 you look at the effects of increased loading on the  
21 battery due to increased numbers of DC-operated pieces  
22 of equipment, specifically HPIC/RCIC.

23 And perhaps if I could ask the licensee,  
24 are HPIC and RCIC the DC taken from the station  
25 batteries here or do they have a separate battery at

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 Hope Creek? Anybody? One or the other?

2 MR. SWARLEY: Hi. I'm Brandon Swarley  
3 from Hope Creek.

4 HPIC and RCIC both have their own battery  
5 systems, 2 50-volt battery systems for each one.

6 MEMBER STETKAR: Okay. Good. Thank you.

7 MR. SWARLEY: You're welcome.

8 MEMBER STETKAR: So the only change,  
9 significant change in loading, might be the additional  
10 SRV cycles.

11 MEMBER SIEBER: Solenoid balance?

12 MEMBER STETKAR: Yes, it would be solenoid  
13 balance. Those are small. Those are small compared  
14 -- thank you. I'm satisfied.

15 MR. McCONNELL: I misunderstood the second  
16 part of your question.

17 MR. GARG: I am Hukam Garg. And I am the  
18 senior electrical engineering in the Instrumentation  
19 and Controls Branch in NRR. I am the presenter on  
20 instrumentation and controls. It is straightforward  
21 to review.

22 All the licensing basis from the previous  
23 parts do stay the same except to account for the  
24 changes in the system. And those changes result in  
25 some changes, which are not too many. There is a bias

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 that we have to take and main steam isolation while on  
2 high steam flow. Those are the setpoint changes.

3 Many instruments have to be re-spanned  
4 because of the change in the system's role or system  
5 conditions. You have to re-calibrate existing  
6 instruments to have the same rhythm. And some of the  
7 instruments have to be replaced.

8 MEMBER BANERJEE: Only APRM or also the  
9 OPRMs change using the setpoints?

10 MR. GARG: Well, PRA needs a setpoint  
11 review by itself. I mean, if they want to install it,  
12 they can install it. But at this time, I think they  
13 are OPRM.

14 MR. DAVISON: Yes. Paul Davison. The  
15 OPRM setpoints will still need to be changed. APRM  
16 and also the main steam on high flow are mentioned,  
17 but OPRMs, yes.

18 MR. GARG: It wasn't submitted with the  
19 application, right?

20 MR. DUKE: This is Paul Duke. That is  
21 correct. OPRM setpoints are not submitted. They are  
22 controlled by the core operating limits report. So  
23 they are changed on a cycle basis under licensee  
24 control.

25 MR. GARG: The license has used the

1 NRC-approved setpoint methodology, which was the  
2 setpoint. And we had issued this composite 2006-17  
3 based on we had a problem with some of the matters  
4 which have been used.

5 And we reviewed those setpoint changes on  
6 those two documents. And we determined that they  
7 continue to mete their licensing basis.

8 The next slide is --

9 MEMBER BANERJEE: Did you review the  
10 ultrasonic flow sensor measurements? For which  
11 instruments are these existing instruments we're  
12 talking about?

13 MR. GARG: Yes. It changes based on the  
14 system requirements. If they have a concern, they  
15 must have installed it before. And there is no change  
16 because of the EPU.

17 MEMBER BANERJEE: Well, it is being  
18 exercised at a higher flow rate, correct?

19 MR. GARG: Yes, but that is not going to  
20 change in there.

21 MEMBER BANERJEE: Why not?

22 PARTICIPANT: If it's within range.

23 MR. GARG: Yes.

24 PARTICIPANT: If it's out of range, you've  
25 got a problem.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. GARG: But, you know, since they are  
2 different and if it is still in the range and they did  
3 not make any change to --

4 MEMBER BANERJEE: Well, at these higher  
5 flow rates, wouldn't they need to validate the  
6 calibration of the --

7 MR. GARG: Well, they will calibrate all  
8 the instruments based on the flow. And, you know, if  
9 they will go through the proper sensing, they are  
10 going to deliver every day. The instruments need to  
11 be calibrated every refueling cycle. So they are  
12 going to go through the recalibrations and all of  
13 those, whether they go through EPU or not.

14 MEMBER BANERJEE: So you didn't determine  
15 whether these instruments, which are fairly critical,  
16 I suppose, will maintain their accuracy after the EPU?

17 MR. GARG: I mean, there is no way we can  
18 determine. I think the licensee come and make that  
19 determination based on their system analysis and --

20 MEMBER BANERJEE: Did they submit any  
21 analysis to show that these instruments will retain  
22 their accuracy? Is that something which is sort of --  
23 I don't know. Is it routinely taken care of or the  
24 end, that's what you do? These measurements will  
25 remain accurate?

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. DUKE: This is Paul Duke. Are we  
2 talking specifically about ultrasonic flow  
3 measurement?

4 MEMBER BANERJEE: Right.

5 MR. HARRISON: We do. Yes, that is going  
6 to be calibrated. I want to ask Paul Davison and  
7 describe what we are going to do. We're not going to  
8 rely on it any longer, but there are plans to  
9 recalibrate it.

10 MR. DAVISON: Yes. I had mentioned before  
11 we have recalibrated coming out of the refuel outage  
12 by statistical comparison to others. On the chart  
13 that I showed you with all of our testing, you see  
14 that each of the final power levels, the 111 and a  
15 half and then 111 and a half with cross-flow.

16 The reason they are broken out separately  
17 is because there's much data to be collected in doing  
18 that comparison again so we can verify its accurate  
19 before we would implement that correct factor to the  
20 venturis and then go up to the 111.5 or eventually the  
21 115.

22 MEMBER BANERJEE: If I remember, you said  
23 there were three separate measurements which you would  
24 then check for consistency against --

25 MR. DAVISON: Correct. Normally the AMAC

1 system is installed on our common header. To do the  
2 checks, we put individual ultrasonics on each of the  
3 three feedwater lines coming from the individual feed  
4 loops, Alpha, Bravo, and Charlie, A, B, C, and use  
5 that data.

6 We also compare it to the venturi, of  
7 course, to make sure that the expected deviation is  
8 within the band. And we have secondary means, such as  
9 turbine first stage pressure, that we also use all to  
10 make sure that we don't end up in an over-power  
11 condition

12 MEMBER SIEBER: These are infinite  
13 ultrasonics or terminate ones?

14 MR. GARG: These are permanent.

15 MR. DAVISON: Paul Davison.

16 Permanent installed.

17 MR. GARG: Next diagram is a standard for  
18 any plant. So I don't know if that is how you do the  
19 calculations. It's for information.

20 CHAIR ABDEL-KHALIK: This is your  
21 presentation, sir.

22 MR. GARG: I mean, unless there is a need  
23 to, I mean, I will go over it depending on the timing,  
24 I mean, if you -- I can go over the diagram. There is  
25 the instrument, the analysis and the safety limit.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1           From there, to account for the uncertainty  
2           in the modeling and all of that, you determine the  
3           analytical limit. And from there take out the total  
4           loop uncertainty, whatever the instrument is going to  
5           have, and determine the limiting trip setpoint.

6           The instrument is normally set at the  
7           lower than the limiting setpoint to allow for  
8           additional margin. And it will be the nominal  
9           setpoint. But they could set anywhere between the  
10          nominal setpoint and limiting setpoint.

11          RIS 2006-17 puts some additional  
12          requirements, which is the acceptable as found  
13          tolerance and acceptable as left tolerance. As left  
14          tolerance is the limit where when you reset the  
15          instrument, it has to be reset within that limit. So  
16          they could assure you that it's not going to exceed  
17          the total loop uncertainty and you are not going to  
18          like the safety limit.

19          And the as found tolerance during any  
20          service, that is how much the instrument is going to  
21          -- should be grown. And if it is beyond that, then  
22          that would take some corrective actions and has to  
23          relay it, whether the instrument is equivalent or not.  
24          And they have to reset it.

25          And that's pretty much all I had to say on

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 that.

2 DR. WALLIS: What is this arrow that says,  
3 "Direction of increasing conservatism"?

4 MEMBER ARMIJO: I don't understand.

5 DR. WALLIS: Presumably as you go --

6 MEMBER ARMIJO: It goes the other way.

7 DR. WALLIS: It goes the other way.

8 MEMBER ARMIJO: That's the way --

9 DR. WALLIS: Does it go the other way?

10 MR. GARG: I agree.

11 DR. WALLIS: Does it go the other way?

12 MR. GARG: It should go the other way.

13 DR. WALLIS: Does this just make me  
14 suspicious of everything else you say on this graph?

15 MR. GARG: No, no.

16 (Laughter.)

17 MEMBER ARMIJO: It shows that we're on our  
18 toes.

19 MEMBER MAYNARD: Even at 5:00 o'clock.

20 CHAIR ABDEL-KHALIK: Well, thank you.

21 Next we'll move to the last staff  
22 presentation.

23 25. SOURCE TERMS AND RADIOLOGICAL CONSEQUENCES

24 MS. DUVIGNEAUD: Good afternoon. My name  
25 is DyLanne Duvigneaud. I am a reactor engineer in the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 Accident Dose Branch in NRR. And today I will be  
2 speaking to you about the source terms and  
3 radiological consequences analyses for the Hope Creek  
4 extended power uprate.

5 In reviewing the Hope Creek EPU source  
6 terms for radwaste systems analysis, the NRC staff  
7 used matrix 9, section 2.9.1 of the review standard  
8 for extended power uprates. The radiation sources and  
9 the reactor coolant were analyzed for constant  
10 pressure power uprate conditions.

11 The NRC staff has reviewed the radioactive  
12 source term and reactor coolant and steam associated  
13 with the proposed EPU and concludes that the proposed  
14 radioactive source term meets the requirements of 10  
15 CFR Part 20, Part 50, appendix I, and GDC-60.

16 DR. WALLIS: Can I ask you something?

17 MS. DUVIGNEAUD: Yes.

18 DR. WALLIS: Maybe you're going to get to  
19 it. On the SER, it says, "The annual public dose from  
20 the plant gaseous effluents, 1.83 times  $10^{-3}$   
21 millirem." That comes out to 1.8 microrem. Is that  
22 really what you mean, microrem, or has another factor  
23 of 1,000 been added by mistake?

24 MS. DUVIGNEAUD: Can you repeat that? I'm  
25 sorry.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 DR. WALLIS: Pardon?

2 MS. DUVIGNEAUD: Can you repeat that for  
3 me? I'm sorry.

4 DR. WALLIS: On page 203 of the SER, it  
5 says that "The annual public dose from the plant  
6 gaseous effluents is 1.83 times  $10^{-3}$  millirem," which  
7 to me means 1.83 microrem. It seems to me that maybe  
8 another factor of 1,000 has been added. Maybe the  
9 applicant has a comment on that.

10 MR. PATEL: My name is Gopar Patel from  
11 Nucor Consulting.

12 This number is true because this  
13 information is derived from our computers.

14 DR. WALLIS: So the number is micro?

15 MR. PATEL: Yes, sir,  $10^{-3}$  millirems.  
16 Yes.

17 DR. WALLIS: Okay. Should be there?

18 MR. PATEL: Yes. Thank you.

19 MEMBER BANERJEE: This is much better than  
20 a coal plant.

21 (Laughter.)

22 DR. WALLIS: Okay. Thank you.

23 MS. DUVIGNEAUD: Okay. In reviewing the  
24 Hope Creek EPU design basis accident radiological  
25 consequences analyses, the NRC staff used matrix 9,

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 section 2.9.2 of the review standard for EPU's.

2 The NRC staff approved implementation of  
3 an alternate source term for Hope Creek on October  
4 3rd, 2001. That AST analyzed Hope Creek's DBA  
5 radiological consequences for its current license  
6 power of 3,339 megawatts thermal.

7 Because the previously analyzed power is  
8 lower than the proposed EPU power level of 3,840  
9 megawatts thermal, the licensee reanalyzed Hope  
10 Creek's DBA radiological consequences. The analyses  
11 follow regulatory guide 1.183.

12 The NRC staff concluded that all  
13 reanalyzed DBAs meet 10 CFR 50.67 and SRP 15.0.1 dose  
14 acceptance criteria, both off-site and in the control  
15 room.

16 Revised DBA dose analyses were submitted  
17 in support of the proposed EPU for the following  
18 accidents: loss of coolant, main steam line break,  
19 fuel handling, control rod drop, and instrument line  
20 pipe break.

21 As part of this review, the NRC staff  
22 confirmed that the assumed control room unfiltered  
23 inleakage is supported by tracer gas testing. For  
24 each of the revised DBAs. the NRC staff performed  
25 confirmatory calculations when deemed necessary?

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 DR. WALLIS: Can I ask you about the  
2 fuel-handling accident? The assumption seems to be  
3 that you drop a fuel assembly. And you generate 124  
4 rods. Where does the 124 rods come from? Is it  
5 something in the regulations? Something in the  
6 regulations, is it?

7 MS. DUVIGNEAUD: No.

8 MR. PATEL: This is Gopar Patel here.

9 This 124 rod assembly damage is given by  
10 GE analysis. So this is input from GE. And we use in  
11 our analysis.

12 MEMBER ARMIJO: You are dropping an  
13 assembly on another assembly?

14 MR. PATEL: Yes. I think we dropped the  
15 assemblies on the coal. And that's damages on the  
16 stored fuel assembly, spent fuel assembly in the pool.  
17 And some of the assembly from the dropping, dropping  
18 material is also damaged. The total is 124 rods.

19 MEMBER ARMIJO: I don't know where they  
20 came up with that number because it is a strange  
21 number.

22 DR. WALLIS: It is a strange number, yes.

23 MEMBER BANERJEE: We must have done some  
24 analysis when using a rod.

25 MEMBER ARMIJO: It's probably before my

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 time.

2 DR. WALLIS: Is this something that's  
3 supposed to be conservative?

4 MS. DUVIGNEAUD: Yes.

5 DR. WALLIS: Is it?

6 MS. DUVIGNEAUD: The licensee has  
7 adequately accounted for the effects of the proposed  
8 EPU. All DBAs meet 10 CFR 50.67 and SRP 15.0.1 dose  
9 acceptance criteria for both off site and in the  
10 control room.

11 The staff concludes that the Hope Creek  
12 plant site and of those mitigating ESFs remain  
13 acceptable with respect to the radiological  
14 consequences of the postulated DBAs.

15 Therefore, the staff finds that the  
16 licensee's proposed EPU is acceptable with respect to  
17 the radiological consequences of DBAs.

18 This concludes my presentation. Are there  
19 any questions?

20 CHAIR ABDEL-KHALIK: Are there any  
21 questions?

22 MEMBER BANERJEE: Does the licensee store  
23 planned or is already storing, doing dry storage of  
24 the source?

25 MR. DAVISON: Paul Davison.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 Yes, we do have interim spent fuel storage  
2 on site outside in external casks.

3 MEMBER BANERJEE: And EPU will increase  
4 the rate at which you will keep this secure somewhat.  
5 I mean, will you have more storage casks, things like  
6 this?

7 MEMBER ARMIJO: To make energy, you need  
8 bundles.

9 MEMBER BANERJEE: I know.

10 MR. NOTIGAN: This is Don Notigan, PSEG.

11 The EPU will not have a direct effect on  
12 the dry cask storage because the cask needs a certain  
13 decay time on the fuel before it goes in.

14 MEMBER BANERJEE: So I missed that.

15 MR. NOTIGAN: The casks require a certain  
16 decay time in the pool before they can put in a cask.  
17 So implementing EPU does not increase that right away.

18 MEMBER ARMIJO: But the discharge fuel  
19 will be forcing the older stuff out of the pool.

20 MR. NOTIGAN: Correct.

21 MEMBER ARMIJO: You don't have room.

22 MR. NOTIGAN: We have adequate room.

23 MEMBER ARMIJO: But it still cannot go out  
24 until it meets the requirements there.

25 MEMBER BANERJEE: But eventually you will

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 have to have more new stuff. You are putting more  
2 fuel in or are you talking it to a higher burnup,  
3 which I don't know, or more even burnup?

4 MR. NOTIGAN: This is Don.

5 We have already evaluated the dry cask  
6 storage requirements. We are not increasing the  
7 number of casks we would need from the original  
8 design. The batch sizes are not increasing that  
9 large.

10 MEMBER BANERJEE: How are you doing that?  
11 Is it just you are holding it up longer or --

12 MR. NOTIGAN: The HoldTech casks require  
13 a certain decay time in the fuel pool --

14 MEMBER BANERJEE: Right.

15 MR. NOTIGAN: -- before they can be placed  
16 in the casks.

17 MEMBER BANERJEE: Right.

18 MR. NOTIGAN: That decay time does not  
19 accelerate because of EPU.

20 MEMBER BANERJEE: That decay time doesn't.  
21 So in order to make this power, you have to burn more  
22 fuel, correct, or take the fuel to a higher average  
23 burnup, one or the other? If you keep the burnup  
24 constant, you're going to have --

25 DR. WALLIS: You have to be burning it

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 faster to get more power.

2 MEMBER BANERJEE: Yes.

3 MR. NOTIGAN: For long-term storage and  
4 multi-cycle studies for Hope Creek, we have determined  
5 the number of casks we need long term.

6 MEMBER BANERJEE: I'm just trying to  
7 understand why.

8 MEMBER ARMIJO: You must make some  
9 assumption of by which time the Department of Energy  
10 will finally take the fuel.

11 (Laughter.)

12 MEMBER BANERJEE: So I guess I am trying  
13 to understand why you don't need more storage casks.  
14 As you are producing more power, you are either taking  
15 the fuel at a higher average burnup or you are going  
16 to --

17 MR. NOTIGAN: Yes. The design of the  
18 ISFSI includes the storage pad as well as the casks.  
19 We have a large capacity for additional casks.

20 MEMBER BANERJEE: Oh, but you'll have  
21 additional casks, correct?

22 MR. NOTIGAN: We have a long-term contract  
23 to bring additional casks if needed.

24 MEMBER BANERJEE: Right.

25 MEMBER ARMIJO: So they planned ahead.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 MR. DAVISON: This is Paul --

2 CHAIR ABDEL-KHALIK: How many bundles are  
3 you going to change every outage at the EPU compared  
4 to how many bundles you are replacing every outage as  
5 --

6 MR. NOTIGAN: Just as a rough comparison,  
7 the additional fuel for cycle 15 was 216. As we go  
8 forward with our multi-cycle analyses, we are only  
9 increasing that by 20 assemblies, equilibrium.

10 MEMBER BANERJEE: So ten percent more?

11 MR. NOTIGAN: Yes.

12 MEMBER BANERJEE: Ten percent more.  
13 That's the answer.

14 CHAIR ABDEL-KHALIK: Thank you.

15 26. PUBLIC COMMENTS

16 CHAIR ABDEL-KHALIK: At this time the  
17 agenda calls for solicitation of public comments. Are  
18 there any members of the public who wish to make  
19 comments?

20 (No response.)

21 CHAIR ABDEL-KHALIK: Hearing none, we will  
22 move on to the next item, which is Committee  
23 concluding comments.

24 28. COMMITTEE CONCLUDING COMMENTS

25 CHAIR ABDEL-KHALIK: At this time we will

1 sort of just go around and see if different members  
2 have their main comments, summarize their comments and  
3 impressions, et cetera.

4 But before we end the meeting, we would  
5 like to be able to provide feedback to both the  
6 applicant and the staff as to how they should proceed  
7 with regard to the presentation to the full Committee.  
8 Presentation to the full Committee is scheduled for  
9 Thursday, April 10th. And it's scheduled for 2 hours  
10 and 45 minutes.

11 So at this time Dr. Banerjee?

12 MEMBER BANERJEE: I think I probably said  
13 more than enough in this. The only real concern I  
14 have, which I think the applicant and the staff have  
15 probably addressed adequately, is related to the steam  
16 dryer.

17 And the thing that reassures me here is  
18 that this is a pretty quiet plant, at least from all  
19 of the indications that we have, though we haven't  
20 seen the comparisons with Vermont Yankee.

21 The only guidance again that I could give  
22 the staff here is that the story supporting this has  
23 to be made more coherent. And it must, in some way,  
24 close the loop between these measures which have been  
25 made in the steam lines and what we expect to happen

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 to the steam dryer.

2 The concerns I have are more of a generic  
3 nature and shouldn't really be a burden on this  
4 applicant, but I think the staff should take seriously  
5 trying to go from these steam line measurements to  
6 what is happening to the streams in the dryer, at  
7 least of the measured systems, like Quad Cities and  
8 later on Susquehanna. And they need to close that  
9 loop in some form of analysis, which they used, which  
10 can be used as confirmatory analysis. So this thing  
11 doesn't keep raising its head each time we go into it.  
12 That's my main comment.

13 CHAIR ABDEL-KHALIK: Dr. Pierce?

14 DR. PIERCE: Just as an ordinary person,  
15 I am impressed that they have a quiet plant. And I  
16 would think my gut feeling is that they wouldn't have  
17 any problems with EPU. However, I am here as an  
18 expert on acoustics.

19 And I guess I might do it. And I have  
20 lots of questions about the acoustics which I would  
21 like to settle for myself. And I learned a lot in  
22 this meeting. I think that what CDI has is innovative  
23 and very clever, but I would like to look at more  
24 thoroughly. And what I will do is try to put these  
25 things in writing in a report to this Committee.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 I don't know if I can make it by April  
2 10th, but I presume this is going to be a problem that  
3 is going to be going on for a long time. So maybe  
4 somebody else should look at it. I guess I am the  
5 guy.

6 CHAIR ABDEL-KHALIK: In order for your  
7 comments to have an impact on the Committee's  
8 deliberations, we have to receive them before --

9 DR. PIERCE: I realize that. However, I  
10 am guessing that this will not be the first or the  
11 last meeting of this type I will have and that steam  
12 dryers are going to be a problem for a while.

13 CHAIR ABDEL-KHALIK: Thank you.

14 Dr. Armijo?

15 MEMBER ARMIJO: Yes. I would like to  
16 comment on the fuels and then also the materials parts  
17 of the presentation. I think the fuel presentation is  
18 clear that the plants, the core has been designed very  
19 conservatively.

20 And I think partly they might make their  
21 presentation a little bit easier on the full Committee  
22 if they just show the actual core map where they have  
23 got a 216 SVEA assemblies, but based on the  
24 enrichment, the burnup, and the loading of those  
25 assemblies, I am sure they are putting out far less

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 than 28 percent of the core thermal power the way they  
2 are loaded.

3 That would help get across to other  
4 Committee members that this is really very  
5 conservatively designed. And so the issues related to  
6 applicability of GE methods to the SVEA fuel would be  
7 not very hard to sell. I don't see any problems with  
8 the fuel.

9 I think the presentation on plant  
10 materials and water chemistry and all the things that  
11 the licensee is doing to protect the plant materials  
12 is right on target, particularly paying very good  
13 attention to their hydrogen water chemistry and noble  
14 metal additions. So I think that that will -- you  
15 know, all of this has to be a bridge, but I think that  
16 will be very good.

17 And then an area that I don't know  
18 anything about -- and that's the dryer and these  
19 acoustics -- I guess I would start with showing these  
20 limit curves and explain how you got there and how you  
21 are going to use them without -- there's no way that  
22 the full Committee can possibly go through an  
23 understanding of how this was developed. I just think  
24 it's just too long.

25 CHAIR ABDEL-KHALIK: Thank you.

1 Dr. Wallis?

2 DR. WALLIS: Well, when I was coming down  
3 here, I thought that my report would be that Hope  
4 Creek made a very credible and open and persuasive  
5 presentation. And so did the staff. And everything  
6 is okay.

7 I think that Hope Creek did make a very  
8 good presentation. And but I do feel like I probably  
9 have to write something about the dryer.

10 And if I were to go back over all those  
11 CDI reports that I looked at and comment on all of  
12 them, I would write a book. That wouldn't really help  
13 the full Committee at all.

14 So I would hope that by the time this gets  
15 to the full Committee, that what Sanjoy Banerjee is  
16 looking for will happen, that someone can make very  
17 clear the link between what is measured in the steam  
18 line, what is predicted in the steam dryer, and what  
19 has been measured in various steam dryers, and show  
20 how this validates an approach which is believable and  
21 reliable and can form the basis for our  
22 decision-making.

23 That's what I wanted to see. And, really,  
24 I have to restrain myself about writing a text about  
25 the various other reports that I have read. I think

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 if that can be done well, that is really all that is  
2 needed.

3 CHAIR ABDEL-KHALIK: That coupled with the  
4 start-up testing?

5 DR. WALLIS: Yes, with the start-up  
6 testing, which, of course, is coupled to that, yes.  
7 Exactly. And you cannot divorce one from the other  
8 because how sure you feel about your ability to  
9 validate and predict influences how careful you are in  
10 your start-up testing.

11 And if it's fatigue failure you're looking  
12 for, you've got to wait for years before it happens.  
13 That is not a good approach at all.

14 MEMBER ARMIJO: IGSCC isn't fast either.

15 DR. WALLIS: Right. So I think that's  
16 enough on that. Thank you.

17 CHAIR ABDEL-KHALIK: Thank you.

18 Mr. Maynard?

19 MEMBER MAYNARD: Well, overall I think  
20 both the applicant's and the staff's presentations  
21 were very good and very informative. I was especially  
22 impressed with the applicant's ability to get the  
23 answers to look-up questions very quickly, rapidly,  
24 and get back to us on those. I think that was very  
25 helpful.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1                   From the staff, the one area that gave me  
2 a little bit of concern was on the human performance  
3 discussion. I didn't get the level of confidence that  
4 the review was a real in-depth review there.

5                   I don't have any real concerns or issues  
6 in that area from what I heard from the applicant and  
7 from what changes are being made, but that was one  
8 area from the staff's perspective that you might want  
9 to just make sure that there is a good review in that  
10 area.

11                   Relative to the dryer, as far as for the  
12 presentation, I don't think we should try to focus on  
13 the details of the methodology. There's no way to  
14 bring everybody up to speed in all of that.

15                   I agree with Dr. Wallis that I think the  
16 real key is tying the links together as to what items  
17 are there relative to scale model testing, relative to  
18 the other plant data that really ties a link that says  
19 this is a reasonable approach to take.

20                   I believe it's a reasonable approach.  
21 First of all, I think it's far better than the  
22 alternatives. The only alternatives that you really  
23 have are either to instrument the existing dryer or  
24 replace it. Either one of those I think is pretty  
25 extreme options that are bad overall.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 To instrument a current one, you pick up  
2 a lot of radiation exposure. And it is very difficult  
3 to do good attacks on the strain gages and other  
4 instrumentation on a used piece of equipment in a  
5 high-radiation area. Putting a new dryer in  
6 definitely unnecessarily you have created a lot of  
7 unnecessary radioactive waste besides the expense and  
8 stuff.

9 And so from an overall public health and  
10 safety and what is right, I think those are two very  
11 poor alternatives in this case. So we get back to the  
12 methodology.

13 I find it acceptable because, again, the  
14 dryer mods that were made prior I think put this in a  
15 substantially better situation than some of the other  
16 dryers that have been evaluated, the current dryer  
17 performance and the load noise levels in there.

18 The methodology itself, while we may still  
19 have some questions, it has received an awful lot of  
20 scrutiny from the staff and from I believe credible  
21 consultants in this area that have taken a good, hard  
22 look at it. And, again, I think it probably is as  
23 good as what is available at this time.

24 I don't think we should ever rely totally  
25 on a method like this. I think that there are other

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 things that give me the confidence. Quad Cities data  
2 that was reviewed after the failure occurred  
3 demonstrated that you can when looking at the various  
4 parameters outside the steam dryer, you can see things  
5 occurring that could indicate significant failure and  
6 things. So I think that provides confidence. And you  
7 don't necessarily have to have instrumentation on the  
8 dryer to get that kind of data.

9 And, again, the methodology isn't really  
10 being totally relied upon and shouldn't be. You have  
11 the testing approach that is monitoring certain  
12 parameters and things as you go up. You have stop  
13 points. And I believe that a combination of all of  
14 those things will identify potentially significant  
15 problems from occurring before they become  
16 catastrophic or real problematic.

17 And I also don't think just because some  
18 time in the future a small fatigue crack or something  
19 might be identified doesn't mean that this thing or  
20 that a decision has been made that is contrary to the  
21 health and safety of the public.

22 I believe that we need to avoid the things  
23 that are the catastrophic, the large things that could  
24 result in a release. And I believe that this provides  
25 an adequate level of assurance that with regard to the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

(202) 234-4433

www.nealrgross.com

1 public health and safety that are going to identify  
2 the problem before it becomes a real big problem.

3 So those are my comments.

4 CHAIR ABDEL-KHALIK: Thank you.

5 Dr. Kress?

6 DR. KRESS: I guess it's unanimous on the  
7 steam dryer. I am fully in agreement with Sanjoy. I  
8 don't think it's a particular issue with this power  
9 uprate for Hope Creek. I do think it would be nice to  
10 close that loop. There may be issues with it on  
11 future plant upgrades. So I think it's not a thing  
12 for Hope Creek but something for the staff to do. And  
13 I would fully support that that gets closed.

14 I see no real stoppers in terms of  
15 granting the power uprate. I do have some thoughts  
16 about the way the staff reviews the risk assessment  
17 part. I don't want to comment on those at this time  
18 because I want to get my thoughts together on it. I  
19 will put them in writing in my consultant's report.

20 CHAIR ABDEL-KHALIK: Thank you.

21 Mr. Stetkar?

22 MEMBER STETKAR: Yes. Despite my rather  
23 critical comments on some parts of the risk  
24 assessment, I have to say that I was quite impressed  
25 with most of the licensee's efforts to demonstrate the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 risk implications from transitioning from the pre-EPU  
2 to the post-EPU conditions.

3 As you probably picked up by my comments,  
4 I would hope that in the full Committee presentation,  
5 there is some better, more coherent justification for  
6 how the internal fire, in particular, and to a lesser  
7 extent the seismic risk translates; in particular,  
8 because that may be a larger contribution to the total  
9 risk than the very good job that was done on the  
10 internal events.

11 Granted, we don't know the total  
12 contribution from internal fires due to a lot of the  
13 things that were discussed today, but there should be  
14 a way to estimate the differential contribution in a  
15 better method than has been done so far. So that's  
16 something to think about in terms of the full  
17 Committee presentation, at least in that topic.

18 CHAIR ABDEL-KHALIK: Mr. Sieber?

19 MEMBER SIEBER: I think overall there are  
20 good presentations, both from the applicant and the  
21 staff. And in general I thought they were very  
22 professional and covered all the issues that I would  
23 have that are matters of concerns in the EPU.

24 Yesterday I was in another subcommittee  
25 meeting. So I didn't have the benefit of the

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 presentations from yesterday. I did get a briefing by  
2 other members on one of my interests, which is the  
3 fuel management aspects of this, and came away from  
4 that conversation impressed by the fact that the  
5 licensee in my opinion is probably spending a little  
6 bit of extra money in order to come up with a  
7 conservative fuel design. And having done that for  
8 about ten years in my own career, I can see what they  
9 did. And that was to make sure that they had plenty  
10 of margin for all of the fuel assemblies. And I think  
11 that that is good engineering intent as far as that  
12 aspect is concerned.

13 The dryer I think is another issue. I,  
14 like some others, don't fully understand all the  
15 implications of the calculations that have been  
16 performed.

17 And so I can't say with 100 percent  
18 certainty that acoustic measurements and various  
19 instrumentation on steam lines is going to tell you  
20 everything there is to know about dryers during  
21 start-up.

22 And it's not clear that because of the  
23 complex geometry of the dryers that you can do a good  
24 enough design to look at each and every weld and know  
25 all the dynamic forces inside the reactor vessel that

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 will have an influence on particularly fatigue  
2 strength of the vessel.

3           What is important to me is enough  
4 assurance that the dryer won't come apart in the first  
5 few months of operation. And I think the analysis  
6 that has been done so far and past operating  
7 experience, this kind of dryer has been put to more  
8 severe service, I think, in a couple of other plants  
9 than it is being put to here, just by the size of the  
10 power uprate.

11           So I have the kind of confidence that at  
12 least it will make it through the cycle. And I think  
13 I compare in my own mind to power piping as an  
14 example. The code tells you how to design and erect  
15 piping systems. And manufacturers of pipe put some  
16 margin in the thickness and so forth.

17           And that doesn't say that that piece of  
18 pipe is going to be in service for 60 years and  
19 provide adequate service. And that's why we have  
20 programs like CHECWORKS and concerns about chemistry  
21 and so forth, but the key to that is inspections, the  
22 in-service inspection program, and management of the  
23 transients that you put on the device, the piping for  
24 the reactor and the dryer.

25           The fact that the approach to the extended

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 power phase to me appears to be very careful, very  
2 deliberate with lots of whole points and so forth  
3 gives me some pretty good amount of confidence that  
4 the applicant will identify a significant failure in  
5 the dryer during the start-up phase.

6 And what we're concerned about is fatigue  
7 cracks that would lead to the failure of significant  
8 parts of the dryer. And so with the analysis that's  
9 been done and the slow start-up and all of the data  
10 that's going to be taken, I have some confidence that  
11 the dryer will last at least one cycle, at which time  
12 we have the first of three cycle inspections.

13 Now, I compare that to the same thing we  
14 do with piping and other pressure vessels and other  
15 components in the plant. You erect them according to  
16 the code. The code has safety margins built into  
17 them. And it is built to a certain amount of  
18 standards.

19 And if you really look at the history of  
20 the code, not all the factors are always in there.  
21 There's margin after margin after margin to make it  
22 easier for the field engineers to design and erect  
23 this stuff.

24 And so I think there's margin in this  
25 particular dryer also. And I rely on the careful

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 start-up and the inspection program to give the amount  
2 of assurance that's necessary to say that it's okay.

3 Okay. So that's how I arrived at that  
4 because otherwise I don't think there's quite enough  
5 to unequivocally say that the dryer isn't going to  
6 fail after quite a number of years of operation.

7 You have to keep watching it, do  
8 inspections, and so forth. And I think that's what  
9 the applicant plans to do. At least that's what he  
10 stated he is going to do.

11 CHAIR ABDEL-KHALIK: Thank you.

12 I think, based on the comments, there is  
13 general consensus that this application should move  
14 forward to the full Committee. Is that the general  
15 consensus? We should be able to write a letter  
16 following the full Committee deliberations.

17 The question then remains as to which  
18 topics should be included in the full Committee  
19 presentation. Obviously we can't go through the  
20 entire -- and I have a list of four. And we may add  
21 or remove some of those. And that list of four is the  
22 steam dryer, the safety analysis, the containment  
23 analysis, and the PRA.

24 MEMBER MAYNARD: What about the fuel?

25 CHAIR ABDEL-KHALIK: I think that's part

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 of safety analysis.

2 MEMBER MAYNARD: Is that part of safety  
3 analysis? I think it's important because it is a  
4 mixed fuel.

5 CHAIR ABDEL-KHALIK: Right.

6 MEMBER MAYNARD: We have to include it in  
7 that.

8 MEMBER SIEBER: And we have a recent  
9 history that we still need to deal with on fuel. So  
10 I think that it should be there, too.

11 MEMBER BANERJEE: Perhaps with the fuel,  
12 in particular, it would be useful to clarify that GE  
13 methods and GE penalties that we put in the past  
14 wouldn't be adequate. And the reasons for this are  
15 clear, but it should be brought home very quickly that  
16 SVEA fuels don't necessarily require a whole new  
17 evaluation and all that sort of thing. That case must  
18 be made pretty succinctly and quickly.

19 CHAIR ABDEL-KHALIK: Right.

20 MEMBER BANERJEE: And the sort of  
21 incorrect fuel loading pattern that we had to begin  
22 with probably wasted one hour of the meeting.

23 MEMBER MAYNARD: We do need to be a little  
24 careful on the fuel analysis. There may be parts of  
25 that that's proprietary as with the dryer that we've

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 got to be careful on when we start talking penalties  
2 and things there.

3 DR. WALLIS: That's what the designated  
4 letter --

5 MEMBER BANERJEE: One thing is to put the  
6 SVEA bundles right in the center and the others in the  
7 periphery so --

8 CHAIR ABDEL-KHALIK: I just want to make  
9 sure that you are not complying that the licensee  
10 should justify the appropriateness of the penalties  
11 that have already been imposed by the staff on GE  
12 methods.

13 MEMBER BANERJEE: I think the staff  
14 outside the scope of this application.

15 DR. WALLIS: Right.

16 MEMBER BANERJEE: I think the staff should  
17 --

18 CHAIR ABDEL-KHALIK: I think those four  
19 topics. Are there any additional topics that any of  
20 the members feel should be included in that list?

21 MEMBER ARMIJO: It doesn't have to take a  
22 lot of time. The work that's done on the water  
23 chemistry and IGSCC, IASCC of vessel internals, that's  
24 well-covered. Put it to bed.

25 MEMBER MAYNARD: I think it is included in

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 one of those, but make sure the power ascension  
2 testing and monitoring is going to be adequate.

3 CHAIR ABDEL-KHALIK: Right. That's part  
4 of the steam dryer presentation ascension.

5 MEMBER MAYNARD: That's part of that.

6 MEMBER STETKAR: I think in the area of  
7 PRA, I don't think it requires a very lengthy  
8 presentation. And I would again emphasize not all the  
9 details about qualifying the PRA and things like that.  
10 Just focus on what was done to evaluate the difference  
11 pre-EPU/post-EPU. That shouldn't take much time.

12 DR. KRESS: And I would include in that  
13 interpretation with respect to whether or not it puts  
14 into question the adequate protection.

15 CHAIR ABDEL-KHALIK: The rationale.

16 DR. KRESS: That's the title. That's the  
17 title, the verdict.

18 MEMBER BANERJEE: If based on the  
19 discussions the staff decided to clarify some of the  
20 conditions that there was some discussion of that,  
21 then that probably should be done at the full  
22 Committee meeting, too.

23 MEMBER MAYNARD: I think the staff has to  
24 cover the license conditions, at least briefly, in the  
25 discussion there.

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 CHAIR ABDEL-KHALIK: I think he's  
2 referring to the GE methods.

3 MEMBER BANERJEE: No, no, not to the GE  
4 methods. I was talking about the dryer.

5 CHAIR ABDEL-KHALIK: Okay. Okay.

6 MEMBER BANERJEE: Not the GE methods. I  
7 think we don't want to get into OLMCPR, SLMCP. It  
8 would take the whole day.

9 CHAIR ABDEL-KHALIK: So you are talking  
10 about the dryer?

11 MEMBER BANERJEE: Right. Of course.  
12 That's part of the process. Because there was some  
13 discussion by the staff that they would do that.

14 CHAIR ABDEL-KHALIK: I hope that both the  
15 applicant and the staff are taking notes of this  
16 discussion.

17 MEMBER MAYNARD: If you give us long  
18 enough, we are going to have you cover all the items  
19 that the --

20 (Laughter.)

21 DR. WALLIS: The real safety and  
22 regulatory issues don't involve the steam dryer. I  
23 think that they should be covered first, and they  
24 should restrict the discussion of the steam dryer  
25 because it has risks getting blown out of all

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 proportion.

2 CHAIR ABDEL-KHALIK: Right.

3 DR. WALLIS: So I think the applicant and  
4 the staff have to be very careful to focus on the  
5 essentials. It sends a message with the steam dryer.

6 CHAIR ABDEL-KHALIK: We have discussed  
7 focusing on the big picture, --

8 DR. WALLIS: Right.

9 CHAIR ABDEL-KHALIK: -- rather than  
10 getting into the details of the model so that --

11 DR. WALLIS: Well, if the big picture is  
12 clear, yes.

13 CHAIR ABDEL-KHALIK: Right.

14 MEMBER MAYNARD: I think we're going to  
15 have to help a little bit with that, with the other  
16 members. The staff and the applicant have some  
17 limitations on how they can control that. I think for  
18 some of the things that we beat to death in the  
19 Subcommittee meeting, we need to --

20 DR. WALLIS: I think you just hope that no  
21 other members read all the reports on the steam dryer  
22 as well.

23 CHAIR ABDEL-KHALIK: Are there any  
24 additional comments for information that we would like  
25 to convey to either the staff or the applicant?

**NEAL R. GROSS**

COURT REPORTERS AND TRANSCRIBERS  
1323 RHODE ISLAND AVE., N.W.  
WASHINGTON, D.C. 20005-3701

1 (No response.)

2 CHAIR ABDEL-KHALIK: Well, on behalf of my  
3 colleagues, I would like to thank both the applicants  
4 and the staff for very information and well-prepared  
5 presentations. Thank you.

6 MEMBER SIEBER: Could you go over the  
7 items again?

8 CHAIR ABDEL-KHALIK: The items are steam  
9 dryer; power ascension testing; safety analysis,  
10 including core design; containment analysis; a short  
11 presentation on PRA; and a short presentation on water  
12 chemistry.

13 MEMBER ARMIJO: As part of the materials?

14 CHAIR ABDEL-KHALIK: Right. The meeting  
15 is adjourned.

16 (Whereupon, the foregoing matter was  
17 concluded at 5:34 p.m.)

18

19

20

21

22

23

24

25

CERTIFICATE

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of:

Name of Proceeding: Advisory Committee on  
Reactor Safeguards

Docket Number: n/a

Location: Rockville, MD

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and, thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings.



Charles Morrison  
Official Reporter  
Neal R. Gross & Co., Inc.

# A CRS Subcommittee on Power Upgrades

NRC Staff Review of Proposed Extended Power Upgrade

For

Hope Creek Generating Station



March 20 - 21, 2008

# Component Evaluation for Hope Creek Proposed EPU Amendment

---

Kamal Manoly, Chief  
Mechanical & Civil Engineering Branch  
Division of Engineering  
Office of Nuclear Reactor Regulation

March 21, 2008

# NRC Review Team

---

- NRR/DE
  - Kamal Manoly
  - Dr. Chakrapani Basavaraju
  - Alexander Tsirigotis
- NRO/DE
  - Thomas G. Scarbrough
  - Dr. Cheng-Ih (John) Wu
- Argonne National Laboratory
  - Dr. Vikram N. Shah, ANL
  - Dr. Stephen A. Hambric, Head, Structural-Acoustics Department, Applied Research Laboratory, Pennsylvania State University
  - Dr. Samir Ziada, Professor and Chair, Mechanical Engineering Department, McMaster University

# Evaluation Areas

---

- Pipe Rupture Locations and Dynamic Effects
- Pressure-Retaining Components and Supports
  - NSSS Piping, Components and Supports
  - Balance of Plant Piping, Components, and Supports
  - Reactor Vessel and Supports
  - Control Rod Drive Mechanism
  - Recirculation Pumps and Supports
- RPV Internals and Core Supports
- Safety-Related Valves and Pumps
- Seismic and Dynamic Qualification of Equipment
- Potential Adverse Flow Effects

# Scope of Review

---

- Methodology and Loads for Constant Pressure Power Uprate
- Stresses and Cumulative Fatigue Usage Factors
- Acceptance Criteria, Code Editions and Addenda
- Functionality Impact on Safety-Related Pumps and Valves, and Piping Overpressurization
- Acoustic and Flow-Induced Vibration Loading and Monitoring

# RCPB and BOP Piping and Supports

- Reactor Coolant Pressure Boundary and Balance-of- Plant piping systems evaluated for EPU conditions
- Limiting main steam and feedwater piping and supports evaluated for higher loads and flow rate
- Other piping less significantly affected by EPU conditions
- Calculated stresses less than the applicable ASME Section III and ANSI B31.1 Code-allowable limits

# Evaluation of Safety-Related Pumps and Valves

---

- Safety-related pumps and valves within scope of ASME Code
- Review focused on EPU effects on functional performance of pumps and valves
- Review acceptance criteria based on 10 CFR Part 50 General Design Criteria and 50.55a(f)

# Potential Adverse Flow Effects

---

- Steam dryer function
- Steam dryer modifications\*
- Dryer review with technical expert assistance\*
- Plant monitoring
- Power ascension test plan
- License conditions

\* = discuss in detail during closed session

# Steam Dryer Function

---

- Remove moisture from steam prior to exiting reactor pressure vessel (RPV) into main steam lines (MSLs) to turbine generator
- No safety function
- Retain structural integrity to avoid generation of loose parts that might adversely impact capability of other equipment to perform safety functions

# Hope Creek Steam Dryer Modifications

---

- Curved hood design
- Steam dryer modifications performed prior to initial operation to improve its structural capability
- No significant steam dryer performance issues during plant operation

# Steam Dryer Review & Findings

---

- NRC staff with contract technical assistance evaluated Hope Creek steam dryer analysis with numerous information requests and meetings
- Audit performed at CDI office in May 2007
- Reasonable assurance that Hope Creek steam dryer is within structural limits for CLTP and extrapolated EPU conditions
- Steam dryer analysis acceptable for EPU amendment

# Plant Monitoring

---

- Vibration acceptance criteria included in Power Ascension Program
- ASME O/M-S/G Part 3 methodology
- Accelerometers and portable vibration instruments
- Visual walkdowns
- Modifications to reduce piping vibration susceptibility

# Power Ascension Test Plan

---

- Acceptance criteria based on Level 1 (power reduction) and Level 2 (power hold)
- EPU startup test procedure
- Methodology for updating limit curves
- Detailed monitoring and analysis program
- Long-term inspection program

# Development of License Conditions

---

- Provide slow and deliberate power ascension with hold points and data evaluation
- Formalize plans for steam dryer and plant instrumentation and other activities
- Specify EPU startup procedure contents
- Provide for licensee/NRC interaction to address plant data, evaluations, walkdowns, inspections, and procedures

# Summary of License Conditions

---

1. Requirements for operation above CLTP:
  - Monitor MSL strain gages
  - Hold at each 5% step above 3339 MWt for 96 hours to evaluate plant performance and conduct walkdowns & provide evaluation to NRC Project Manager
  - If Level 1 MSL limit curves exceeded, return to lower power and justify integrity
  - Monitor RPV water level instrumentation and MSL accelerometers for resonance frequencies
    - o stop power ascension if resonance frequencies are identified
    - o evaluate structural integrity of dryer and provide results to NRC
    - o obtain NRC approval prior to power increase

# Summary of License Conditions

---

## 2. PSEG implement the following:

- If acoustic resonance that challenges limit curves is identified, evaluate dryer loads and re-establish limit curves
- Update dryer reports for 111.5% and 115% CLTP including re-established limit curves with updated ACM load definition
- If limit curve challenged, perform structural evaluation
- Revise plant procedures to reflect long-term monitoring for potential dryer failure
- Revise inspection program to reflect BWRVIP-139
- Submit final EPU load definition upon completion of power ascension test program
- Submit flow-induced vibration portions of startup test procedure prior to exceeding CLTP

# Summary of License Conditions

---

3. Startup test procedure includes
  - Dryer acceptance criteria and MSL limit curves
  - Hold points with activities, and parameters, monitored
  - Inspections & walkdowns for steam, feedwater & condensate systems & components during hold points
  - Methods & acceptance criteria for monitoring & trending parameters including actions taken if acceptance criteria are exceeded
  - Verify completion of planned actions

# Summary of License Conditions

4. Attributes of power ascension plan not to be made less restrictive without prior approval
5. During the first RFO after cycle 15 and the first 2 RFOs after reaching full EPU, visual inspection of dryer with BWRVIP-139 guidelines
6. Dryer inspection results report to NRC within 90 days of startup; results of power ascension testing confirming steam dryer structural integrity within 60 days from completion of cycle 15 power ascension testing; and supplement report within 60 days of completion of all EPU power ascension testing.

# Summary of License Conditions

---

7. License condition expires if dryer inspection does not reveal any new unacceptable flaws or unacceptable flaw growth due to fatigue.

8. Provide Level 1 main steam SRV vibration acceptance criteria prior to exceeding CLTP.

# Conclusion

---

- Hope Creek components will continue to meet GDC following EPU implementation.
- Reasonable assurance that Hope Creek steam dryer is within structural limits for CLTP and extrapolated EPU conditions.
- EPU amendment acceptable with respect to component evaluation.
- License conditions establish provisions for monitoring and evaluating plant data, and taking prompt action if necessary.

# EPU Power Ascension And Testing

---

Robert L. Pettis, Jr.  
Senior Reactor Engineer  
Quality and Vendor Branch  
Division of Engineering  
Office of Nuclear Reactor Regulation

# EPU Test Program

---

- Standard Review Plan (SRP) 14.2.1, "Generic Guidelines for Extended Power Uprate Testing Programs," specifically developed for EPUs, provides guidance for staff reviews of proposed EPU test programs; based on Regulatory Guide 1.68 and plant specific initial test program.
- EPU test program should include testing sufficient to demonstrate structures, systems, and components will perform satisfactorily at the proposed uprated power level.

## EPU Test Program (continued)

---

- Staff guidance considers original power ascension test program and EPU-related plant modifications.
- SRP guidance acknowledges that licensees may propose alternative approaches to testing with adequate justification. Specific review and acceptance criteria provided in SRP for staff evaluation of alternative approaches.

# EPU Test Program (continued)

---

- HCGS's program consists primarily of steady-state testing; does not include Large Transient Testing (LTT), e.g., MSIV closure and generator load rejection testing.
  - Test program will monitor important plant parameters during EPU power ascension;
  - TS surveillance and post-modification testing will confirm the performance capability of the modified components; and
  - Power ascension follows staff approved GE Constant Pressure Power Uprate (CPPU) licensing topical report (LTR).

# Large Transient Testing

---

- PSEG's justification for not performing LTT addressed the review criteria discussed in SRP 14.2.1; consistent with previous staff approved EPU's.
  - Industry operating experience, including unplanned events at HCGS involving turbine trips and generator load rejections which produced expected results;
  - No new thermal-hydraulic phenomena or new system interactions identified;
  - Limited scope of EPU modifications for balance-of-plant systems;

# Large Transient Testing (continued)

---

- Transient evaluations performed by GE included LTT at full EPU conditions (reference: HCGS PUSAR);
- No unique limitations associated with conformance to analytical methods;
- LTT not required for plant procedure verification or operator familiarization; and
- PSEG's conformance to NRC staff approved GE LTRs.

# Staff Summary

---

- SRP 14.2.1 allows licensee justification for not performing all initial test program power ascension tests;
- LTT not needed for Code analyses benchmarking;
- Staff considered HCGS LTT operating history, industry experience, and no introduction of new credible thermal-hydraulic phenomena;
- Limited scope of EPU modifications; and
- Conformance to staff approved GE LTRs.

# Staff Conclusion

---

- The proposed PSEG EPU test program for the HCGS satisfies the requirements of 10 CFR 50, Appendix B, Criterion XI, "Test Control," and
- The proposed EPU test program addressed the guidance and review criteria established in SRP 14.2.1 for EPUs.

Hope Creek  
Constant Pressure Power Uprate  
NRC Staff Review of Risk Evaluation

---

Donald G. Harrison, Chief  
Balance of Plant Branch  
for  
Probabilistic Safety Assessment Branch  
Division of Risk Assessment  
Office of Nuclear Reactor Regulation

## In a Nutshell...

---

- The proposed CPPU does not create “special circumstances” that rebut the presumption of adequate protection provided by the licensee meeting the currently specified regulatory requirements.

# CPPU Risk Review Guidance

- Hope Creek CPPU application is not “risk-informed” (i.e., not evaluated per RG 1.174 acceptance guidelines)
- Application and review follows RS-001, Rev. 0, Matrix 13, “Risk Evaluation”
- Staff review is consistent with SRP Section 19.2, Appendix D, “Use of Risk Information in Review of Non-risk-informed License Amendment Requests”
  - Determine if “special circumstances” exist that could potentially rebut the presumption of adequate protection provided by the licensee meeting the currently specified regulatory requirements
  - In so doing, confirm that risks are acceptable

# CPPU Risk Review Guidance

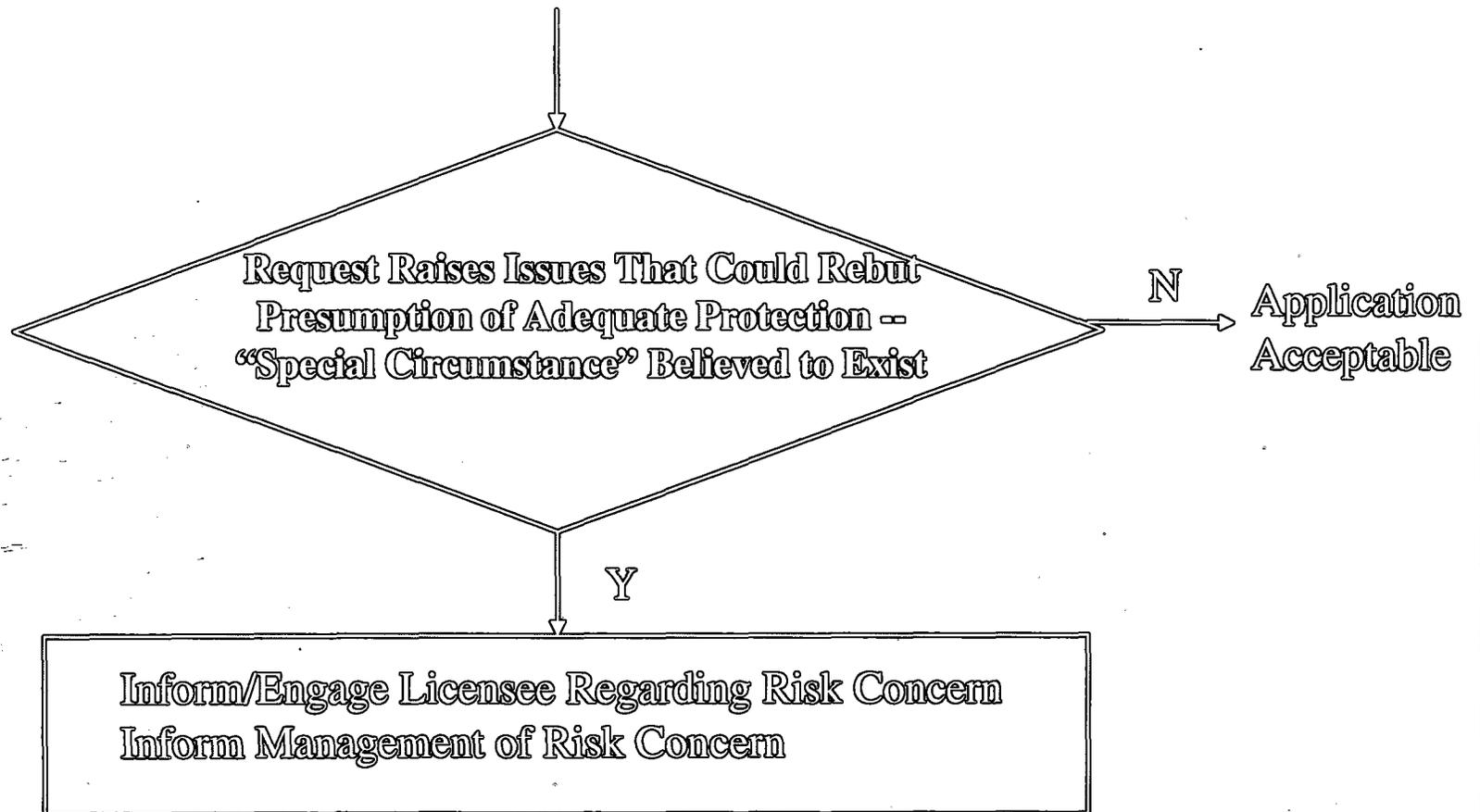
---

- Issues that could rebut the presumption of adequate protection
  - Situation not identified/addressed in development of regulations & could be important enough to warrant new regulation if encountered on a widespread basis
  - Reviewer has knowledge that risk impact is not reflected by licensing basis analysis and has reason to believe that the risk increase would warrant denial if request were evaluated as a risk-informed application



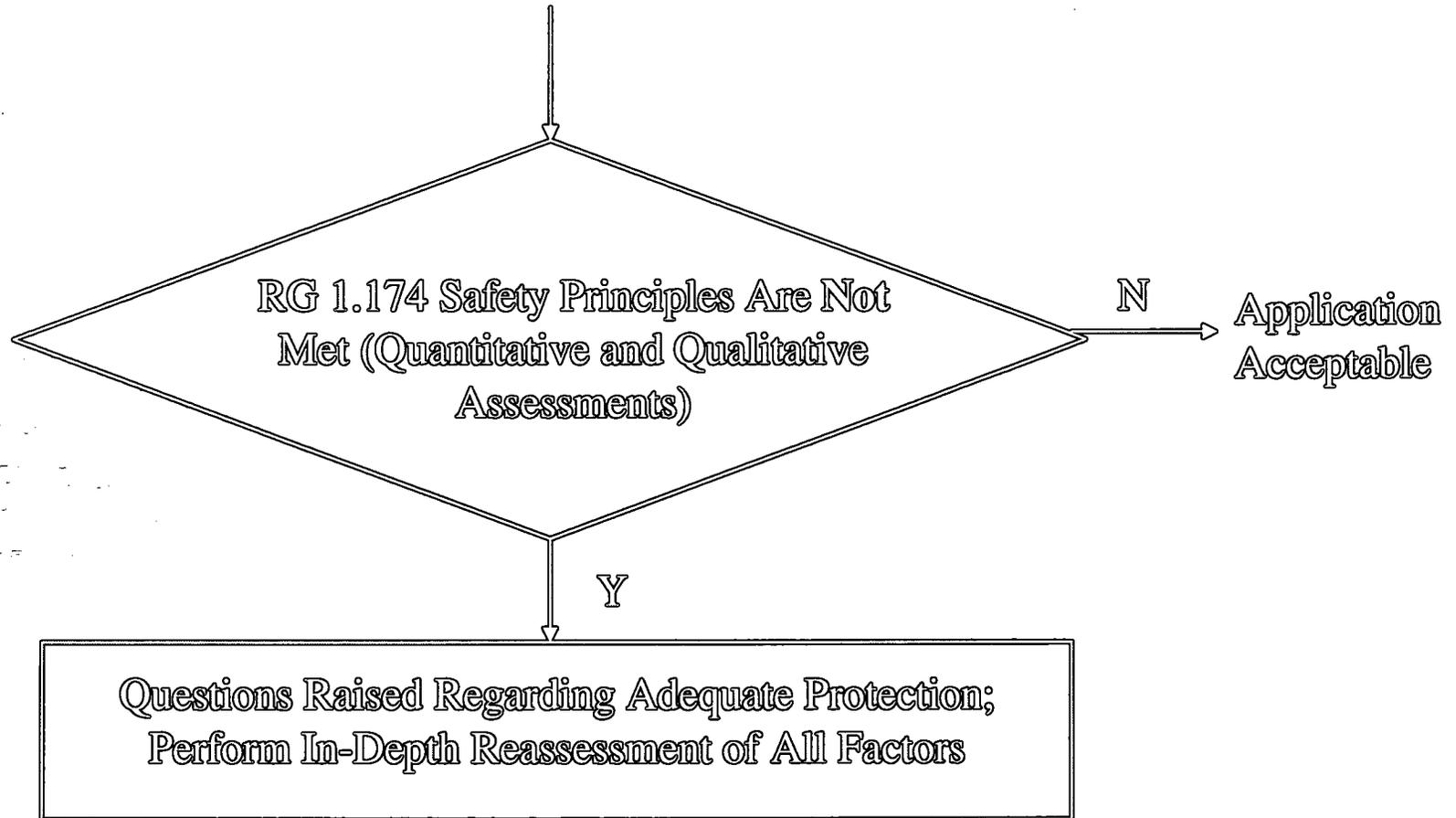
# CPPU Risk Review Guidance

Non-Risk-Informed Submittal That Meets  
Deterministic Requirements



# CPPU Risk Review Guidance

IF MANAGEMENT AGREES "Special Circumstance" Exists; Request and Evaluate Risk Information



# Core Damage Frequency Results

	Pre-EPU	Post-EPU	Change
Internal events, including internal floods	9E-6	1E-5	7E-7
↳ Turbine trip frequency	3E-7		
↳ Reduced time for operator actions	3E-7		
↳ Increase in SORV probability	1E-8		
↳ Depressurization success criteria	5E-9		
↳ ATWS overpressure protection	<5E-11		
Internal fires	2E-5	2E-5	1E-6
Seismic events	3E-6	3E-6	8E-9
Total	3E-5	3E-5	2E-6

# Large Early Release Frequency Results

	Pre-EPU	Post-EPU	Change
Internal events, including internal floods	2E-7	3E-7	6E-8
Internal fires	not estimated		
Seismic events	2E-7	2E-7	0
Total	4E-7	5E-7	6E-8

# Risk Review Conclusions

---

- Licensee has adequately modeled and/or addressed the potential risk impacts of the proposed CPPU.
- Risks are acceptable because RG 1.174 risk acceptance guidelines are met.
- The proposed CPPU does not create “special circumstances” that rebut the presumption of adequate protection provided by the licensee meeting the currently specified regulatory requirements.

# Materials Engineering Topics

---

Matthew A. Mitchell

Branch Chief

Vessels & Internals Integrity Branch  
Division of Component Integrity  
Office of Nuclear Reactor Regulation

# Reactor Vessel Integrity

---

## Applicable Regulations

- 10 CFR Part 50, Appendices G and H

## Topics of Interest

- Reactor Vessel Pressure-Temperature (P-T) Limit and Upper Shelf Energy (USE) Analysis
- Reactor Vessel Material Surveillance Program

# Reactor Vessel Integrity

---

- Reactor Vessel Material Surveillance Program
  - Licensee has implemented BWRVIP Integrated Surveillance Program
- Reactor Vessel P-T Limits
  - Existing P-T limits remain valid for 32 EFPY
- Reactor Vessel USE Analysis
  - Acceptable with all materials remaining above the 50 ft-lb screening limit

# Chemical Engineering

---

Matthew Yoder

Senior Materials Engineer

SG Tube Integrity & Chemical  
Engineering Branch

Division of Component Integrity  
Office of Nuclear Reactor Regulation

# Protective Coating Systems (Paints)

## - Organic Materials

### Regulatory Evaluation

- 10 CFR Part 50, Appendix B
- Regulatory Guide 1.54, Rev. 1, "Service Level I, II, and III Protective Coatings Applied to Nuclear Power Plants"
- ANSI and ASTM standards
- Standard Review Plan Section 6.1.2, "Protective Coatings Systems (Paints) – Organic Materials"

# Protective Coating Systems (Paints)

## - Organic Materials

- Original Service Level I coating application predates RG 1.54, but most coatings qualified to ANSI N101.2.
- Containment temperature, pressure, and radiation dose at EPU conditions are within the qualification conditions for coating degradation and adhesion.
- Coating inspection, maintenance, repair performed according to standards and procedures based on ASTM and NRC guidance.

# Flow-Accelerated Corrosion

## Regulatory Evaluation

- Generic Letter 89-08, "Erosion/Corrosion Induced Pipe Wall Thinning"
- EPRI NSAC-202L, "Recommendations for an Effective Flow-Accelerated Corrosion Program"
- Design code minimum wall thickness

# Flow-Accelerated Corrosion

- Some changes in variables that affect FAC.
  - Primarily velocity and temperature
- Components are being added to the program based on the potential for an increased FAC rate at EPU conditions.
- CHECWORKS computer models are being updated prior to implementing the EPU.
- At EPU conditions the FAC program remains consistent with industry guidelines.

# Reactor Water Cleanup System

## Regulatory Evaluation

- GDC 14, Reactor coolant pressure boundary
- GDC 60, Control of releases of radioactive materials to the environment
- GDC 61, Fuel storage and handling and radioactivity control
- SRP Section 5.4.8, "Reactor Water Cleanup System"

# Reactor Water Cleanup System

- Changes to system operating conditions are small compared to design limits.
- Filter/demineralizers can remove the additional impurity load in the RWCU system without operational changes.
  - Principally iron
- Increase in liquid and solid radwaste will not challenge system capacity.

# Electrical Systems

Matthew McConnell & Sheila Ray

Electrical Engineering Branch

Division of Engineering

Office of Nuclear Reactor Regulation

# Electrical Systems Regulations

- 10 CFR 50.49
  - Environmental Qualification
- 10 CFR 50.63
  - Station Blackout
- 10 CFR Part 50, Appendix A, GDC-17
  - Electrical Power Systems

# Electrical Systems Evaluation

- Existing environmental qualification remain valid
- Loading on safety equipment remains bounding
- Safe operation under increased electrical output and increased plant load
  - Grid stability study

# Affected Electrical Systems

- Main Generator
  - Isolated Phase Bus Ducts
  - Main Bank Transformers
  - Stator Cooling
- Switchyard
  - 500kV Circuit Breaker

# Summary

- The Electrical Engineering Branch staff found the following areas acceptable for operation at uprated conditions:
  - Environmental Qualification of Electrical Equipment
  - Offsite Power Systems
  - Onsite Power Systems
  - Station Blackout

# Instrumentation and Controls

Hukam Garg

Senior Electrical Engineer

Instrumentation & Controls Branch

Division of Engineering

Office of Nuclear Reactor Regulation

# Suitability of Existing Instruments

EPU resulted in many changes to existing instruments

- Setpoint changes to APRM flow biased reactor trip for two loop and single loop operation and Main Steam Isolation on high steam flow
- Re-span existing instruments
- Re-calibrate existing instruments
- Replace existing instruments

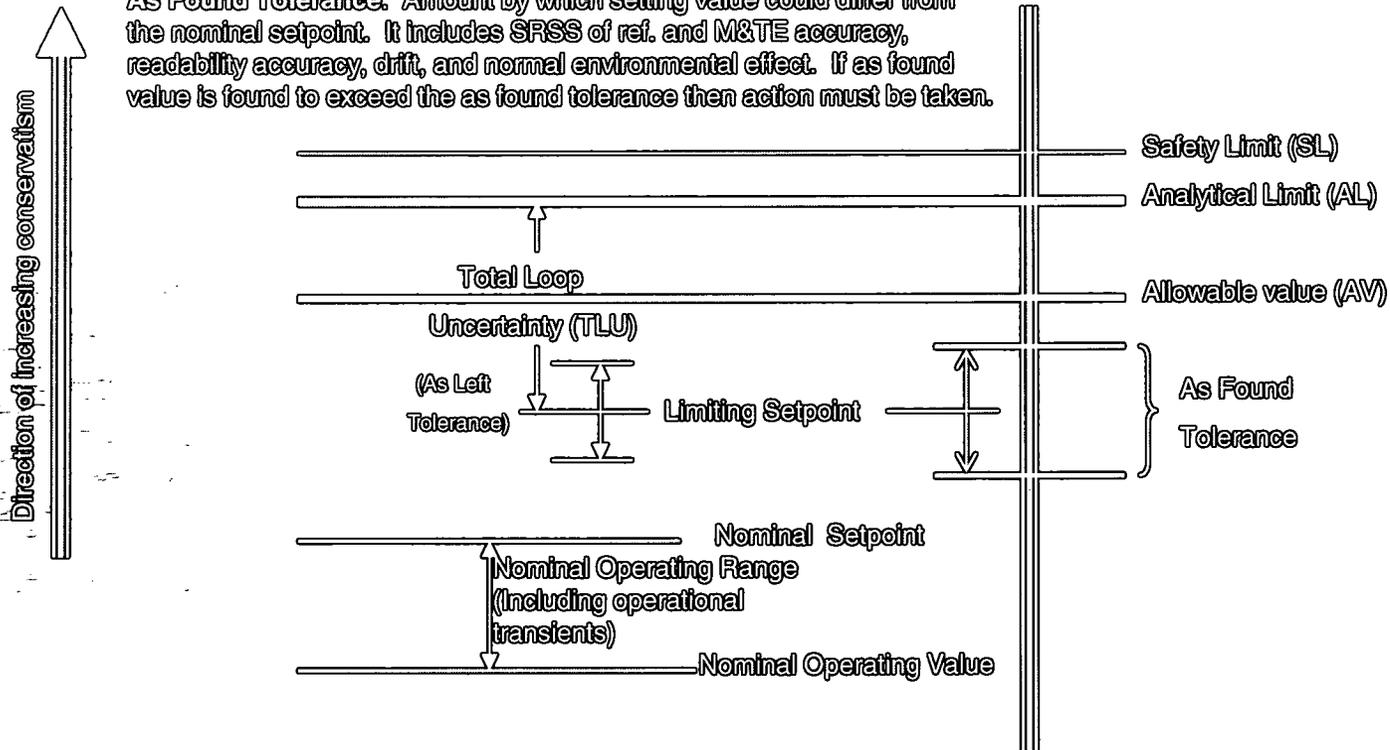
# Instrument Setpoint Methodology

- Instrument setpoint methodology was reviewed by the staff and found acceptable. Used previously accepted GE setpoint methodology (NEDC-31336P-A) and guidance of RIS 2006-17.
- Hope Creek continues to meet its current licensing basis

# Setpoint Parameter Relationship

**As Left Tolerance:** Amount by which setting value is permitted to differ from nominal setpoint. It includes SRSS of ref. and M&TE accuracy and readability accuracy.

**As Found Tolerance:** Amount by which setting value could differ from the nominal setpoint. It includes SRSS of ref. and M&TE accuracy, readability accuracy, drift, and normal environmental effect. If as found value is found to exceed the as found tolerance then action must be taken.



# Source Terms and Radiological Consequences Analyses

DyLanne Duvigneaud

Reactor Engineer

Accident Dose Branch

Division of Risk Assessment

Office of Nuclear Reactor Regulation

# Source Terms for Radwaste Systems Analysis

- Reviewed using Review Standard for Extended Power Uprates
- Radiation sources in reactor coolant analyzed for CPPU conditions
- Continue to meet requirements of 10 CFR Part 20, 10 CFR Part 50, Appendix I, and GDC-60

# DBA Radiological Consequences Analyses

- Reviewed using Review Standard for Extended Power Uprates.
- On October 3, 2001, NRC issued Amendment No. 134 to Hope Creek approving implementation of a full-scope Alternate Source Term (AST) per 10 CFR 50.67.
- This AST amendment was based on a pre-EPU licensed power of 3339 MWt.

# DBA Radiological Consequences Analyses

- Hope Creek's EPU amendment request included a reanalysis of all DBA radiological consequences for the EPU level of 3840 MWt in accordance with RG 1.183.
- All DBAs meet 10 CFR 50.67 and SRP 15.0.1 dose acceptance criteria both offsite and in the control room.

# DBA Dose Analyses in AST Submittal

- ✓ LOCA
- ✓ MSLB
- ✓ FHA
- CRDA
- ILPBA
- The assumed CR unfiltered inleakage is supported by tracer gas testing.

# DBA Radiological Consequences Analyses

- Licensee has adequately accounted for the effects of the proposed EPU.
- All DBAs meet 10 CFR 50.67 and SRP 15.0.1 dose acceptance criteria both offsite and in the control room.
- The staff finds the proposed EPU acceptable with respect to the radiological consequences of DBAs.

# Hope Creek Safety Relief Valve (SRV) Performance

## Set Points:

4 @ 1108 psig, +/- 3%, (1074.8 – 1141.2 psig)

5 @ 1120 psig, +/- 3%, (1086.4 – 1153.6 psig)

5 @ 1130 psig, +/- 3%, (1091.1 – 1163.9 psig)

## T.S. Change:

Amendment 115 – April 1998

1% to 3% Tolerance

# Hope Creek SRV Performance

## SRV Changes:

BWROG Recommendations Implemented

- Stellite-21 Pilot Valve upgrade (all 14 valves)
- Improved maintenance practices for seat lapping

## SRV Performance (post-1998):

Cycle 9 - 2 Failures (+7.8%, +3.1%)

Cycle 10 - 3 Failures (+4.6%, +5.5%, 8.6%)

Cycle 11 - 8 Failures (+3.1%, +3.8%, +4.0%, +5.0%, +5.3%, +5.8%,  
+6.3%, +7.5%)

Cycle 12 - 5 Failures (+3.6%, +4.3%, +4.8%, +5.5%, +6.8%)

Cycle 13 - 3 Failures (+3.2%)

----- Modification Implemented

Cycle 14 - 0 Failures

## Hope Creek SRV Performance

### **ASME Over-Pressure Protection:**

- **Bounding analysis performed in support of the SRV Set Point Tolerance change from 1% to 3%**

One non-functioning SRV and

Balance of SRVs assumed set point of 1250 psig

Result – 1331 psig (Bottom Head)

44 psig margin to ASME Upset Limit of 1375 psig

- **Low-Low Set feature of “H” & “P” SRVs is not credited**

Safety Related, Activated at 1047 psig

Auto pressure control: H – 1017 to 905 psig, P – 1047 to 935 psig

# Hope Creek SRV Performance

## Conclusion:

SRV Performance Deficiencies Recognized

Active participation with Industry Users Group (BWROG)

Modifications Implemented in 2006

Initial results favorable – 0 Failures

Low-Low Set Down Not Credited and provides Margin

Bounding analysis performed

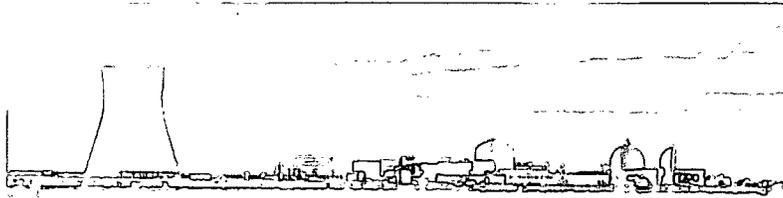
## Hope Creek ECCS Pump Performance

**LP Unavailability: Top Quartile – 0.43 %**

**HP Unavailability: Top Quartile – 0.53 %**

**Quarterly IST Results – Acceptable Performance  
No Increased Frequency Testing**

2-21-08



# Vessel Internals and Steam Dryer

Paul Davison

Site Engineering Director



2-1

NON-Proprietary Version

# HCGS RPV & Internals – EPU Effects

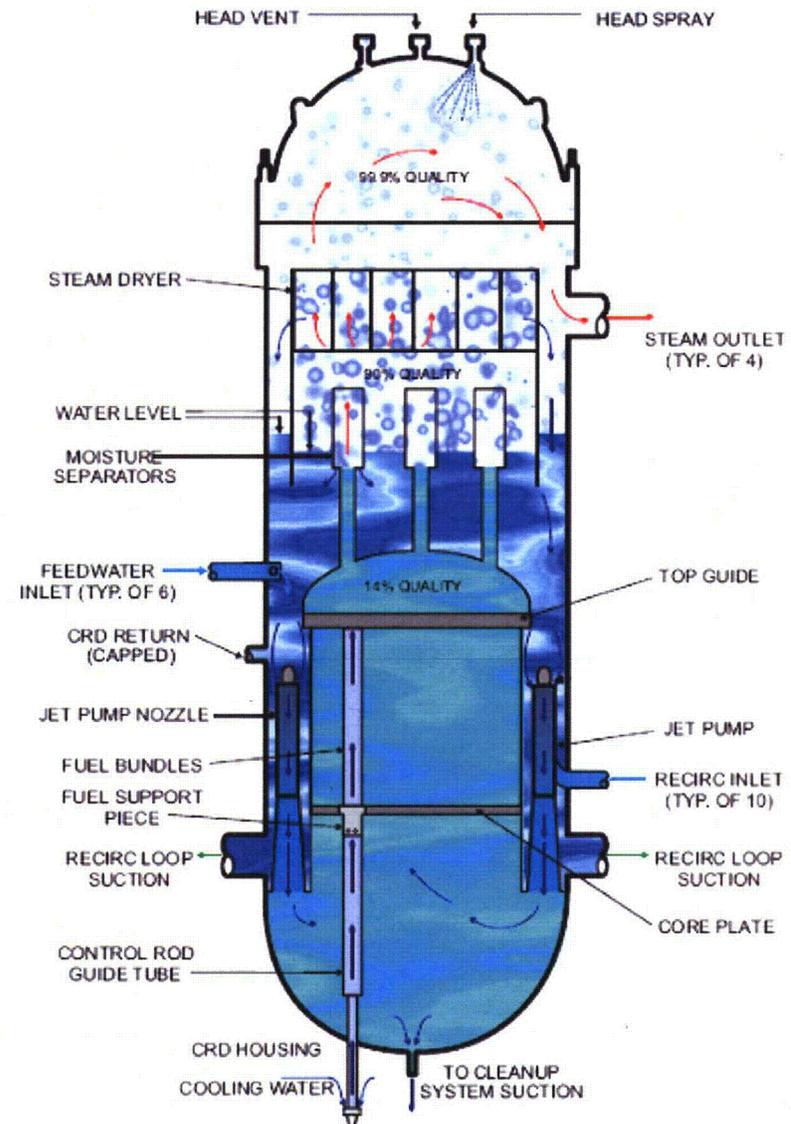
Fluence

Flow Induced Vibration (FIV)

Structural Effects

IGSCC

Post-EPU confirmation inspections



## Irradiation-Assisted Stress Corrosion Cracking (IASCC)

- Components exceeding IASCC fluence threshold of  $5 \times 10^{20}$  n/cm<sup>2</sup>
  - Shroud
  - Top Guide
  - Incore Dry Tube Assembly
- Shroud inspection remains IAW BWRVIP-76.
- Top Guide inspection program will be implemented following EPU
  - Grid beams will be inspected IAW BWRVIP-183
  - 10% cells will be inspected within 12 years, 5% in 6 years
  - Sample locations will be high fluence locations
- Incore dry tubes will be inspected IAW GE SIL 409

## EPU Flow Induced Vibration - RPV Internals

### Results of evaluation – EPU will not adversely affect RPV internals

- Vibration levels for EPU estimated by extrapolating prototype plant data and GE experience
- Shroud, shroud head & moisture separator, jet pumps, feedwater sparger well below GE acceptance criteria
- Jet pump sensing lines – no resonance with recirc pump vane passing frequency

### Results of evaluation – EPU will not adversely affect RPV

- Evaluated components with CLTP fatigue usage factor  $>0.5$  and experience changes in operating parameters
  - All remained acceptable with respect to stress and fatigue.
    - Main Closure Studs
    - Shroud Support
    - Core Spray Nozzle
- Verified that modified components, three RPV nozzle weld overlays, acceptable for EPU operation.
- Hope Creek has no ASME flawed components accepted for continued service by analytical evaluations

### IGSCC program implementation not changed by EPU

- EPU causes slight changes to temperature, pressure and flow for reactor coolant pressure boundary materials; negligible effect on tensile stresses
- EPU results in higher oxygen generation rates; hydrogen injection rates will be adjusted to compensate
- No material changes as a result of EPU

## Post-EPU Confirmation Inspections

### Jet pump wedges IAW BWRVIP-41, Rev. 1

- Changed core resistance

### Feedwater spargers and end brackets

- Increased flow

### Shroud head bolts

- Increased feedwater flow impacts bolts

# Steam Dryer

**Steam Dryer Design**

**Margin**

**Power Ascension Test Plan**

# Hope Creek Steam Dryer Design

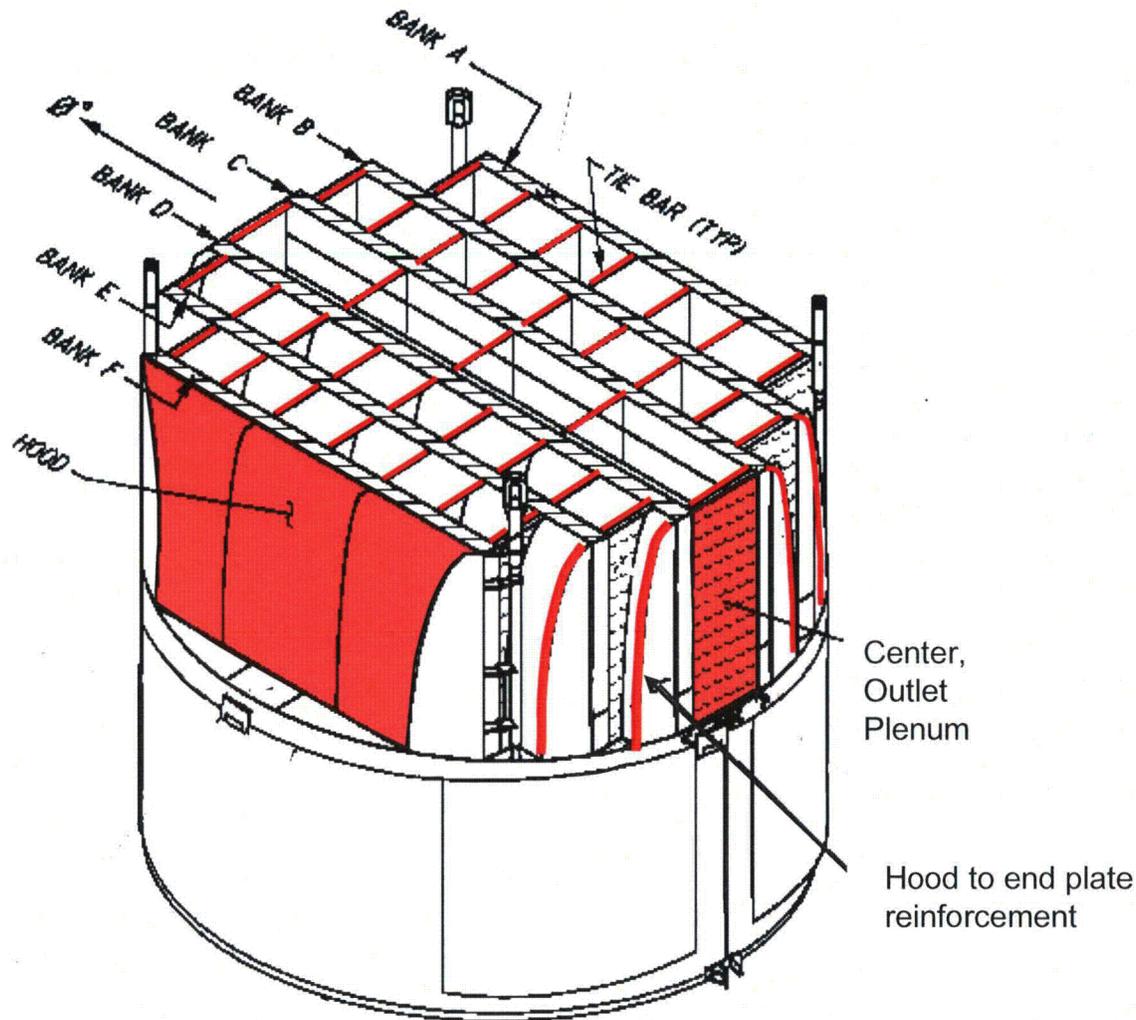
## Curved Hood

- 3rd generation of GE steam dryer design
- Modified on-site prior to operation

## Baseline Inspections done

- Per BWR VIP recommendations
- No fatigue cracking identified

# Hope Creek Steam Dryer Design



**Outer Hood 0.5"**

**Center outlet Plenum  
0.5"**

**Tie-bars 2" x 2"**

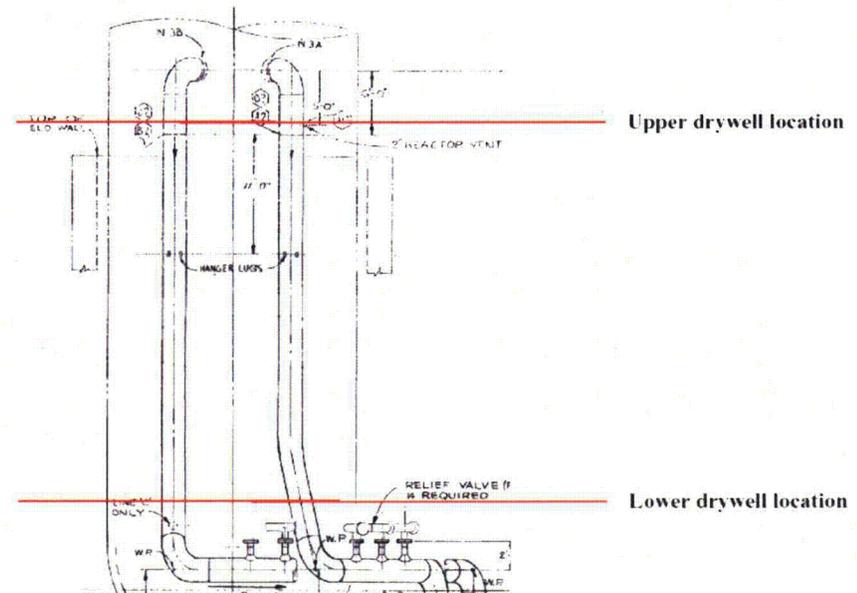
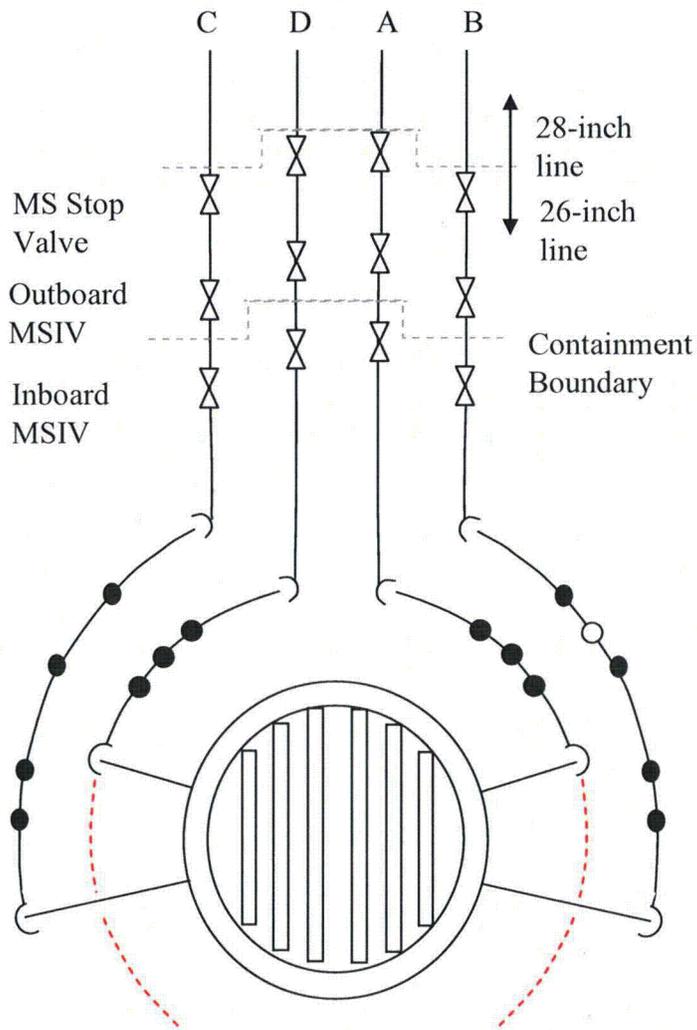
**Reinforced middle and  
inner hood to end plate  
joint**

**Support lugs on RPV ID  
(not shown) leveled**

# Steam Dryer Comparisons

	MSL Flow Velocity (ft/sec) OLTP	MSL Flow Velocity (ft/sec) EPU	Dryer Configuration	EPU Operation	MSL Branch Dead Legs
Vermont Yankee	140	168	Square Hood	120% OLTP	None
Quad Cities Unit 2	168	202	Square Hood	117% OLTP	None
Susquehanna Units 1 and 2	135	153	Curved Hood	120% OLTP	Loops A and D
Hope Creek	141	167	Curved Hood	116.6% OLTP	None

# Hope Creek Main Steam Lines



Dashed red-lines show location of SESS 26-inch MSL dead branches, which do not exist at HCGS.

## Results of FEM for 115% CLTP at Limiting Locations (< 2.5)

Locations (all are welds)	Stress Ratio SR-alternating	Stress Ratio SR-Peak	Shift
Outer hood vane bank /perforated entry plate	2.18	4.64	-7.5%
Inner hood / hood support (stiffener)	2.22	4.64	+5.0%
Middle vane bank / base plate	2.24	4.59	+5.0%
Outer hood vane bank top vertical plate / perforated entry plate	2.27	4.72	-7.5%
<b>Skirt / upper support ring</b>	9.36	<b>1.58</b>	<b>0%</b>
Inner hood / outlet plenum end plate	4.34	1.83	-10%
Cover plate / outer hood	3.72	2.42	-7.5%
Inner vane bank side panel / outlet plenum end plate	23.98	2.43	+5%

# Steam Dryer Power Ascension

## Monitoring

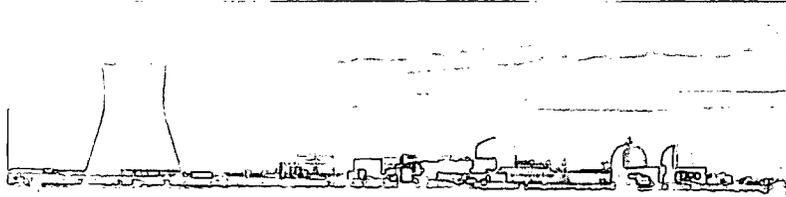
- MSL strain gages
- MSL accelerometers
- MSL moisture carryover

## Evaluation

- Strain gage limit curves
- Power ascension rate of  $< 1\%$  CLTP/hr
- Collection of strain gage data at every 1% increase
  - Used for trending
- Evaluation every 2.5% power
- Power plateaus at each 5% power step and final EPU power

## Reporting

- Provide data for NRC review at each plateau (5% power)



## CDI Analytical Models

Paul Davison

Site Engineering Director

Dr. Alan Bilanin

Continuum-Dynamics Inc.



## **Steam Dryer Overview**

**Strain gage data shows a relatively quiet plant.**

**ACM revision 4 used to improve predictions at low frequencies**

**FEM performed with harmonic domain methodology for more accurate results**

**Biases and Uncertainties were accounted for in both ACM & FEM**

**Alternating stress ratios at EPU remain above 2**

**Slow and Measured Power Ascension Plan**

# Strain Gage Data Comparison With Other Plants

[[

(3)]]

# Strain Gage Data Comparison With Other Plants

[[

(3)]]

# Acoustic Circuit Model Revision 4

## Revision 4

- 0 Hz - 60 Hz - [[  
(3)]]

**Revision 4 is identical to Revision 2 for 60 Hz – 200Hz**

## Revision 4

- Based on Benchmark of Quad Cities utilizing Hope Creek's EPU Mach Number

**Blind Benchmark of Quad Cities was completed at higher Mach Number**

- ACM Predictability same at both power levels



[[

(3)]]

## Finite Element Model

### **Performed in harmonic domain which results in more accurate results**

- Harmonic domain utilizes 1% damping over entire frequency range
- Time domain requires “pinning” structural damping at two frequencies
  - Between the two pins, damping was under-predicted
  - Below the lower pin and above the higher pin, damping was over-predicted
- Actual stress for each frequency can be quickly calculated

### **Benchmarked time domain and frequency domain**

- Results the same when differences in damping are accounted for

## Acoustic Circuit Model Input

Pressures are deduced from circumferential strain measurements made on Main Steam Lines

Strain measurements contain noise in addition to acoustic pressure fluctuations

Strain measurements are conditioned by removing following noise signals

- [[

- 

- 

- 

(3)]]

Most significant impact of signal conditioning occurs at [[

- 

(3)]]

# ACM Rev 4 Bias and Uncertainty

[[


(3)]]

Strain Gage Error [[ (3)]]

Strain Gage Location Error [[ (3)]]

Pressure Sensor Error [[ (3)]]

Total Bias & Uncertainty accounted for by increasing applied load.

### FEM modeling benchmark

- Independently validated CDI's capability to model a complex structure
- Developed a Unit 2 Steam Dryer FEM
- Performed Forced Vibration Test utilizing Hope Creek Unit 2 steam dryer

**FEM Predictions Compared Favorably with Test Data**

**FEM Bias and Uncertainties Derived**

# Finite Element Model Bias and Uncertainty

Source	Effect on Bias (%)	Effect on Uncertainty (%)
Shaker Tests	[[	
Discrete Mesh Error		
Discrete Frequency Error		(3)]]

**Bias and Uncertainty are not frequency dependent**  
**Calculated loads increased by FEM bias and uncertainty.**

## **Finite Element Model Bias & Uncertainties**

**Frequency shift of load between  $\pm 10\%$**

**Lowest stress ratio among all shifts was used as stress ratio for that node**

## Predicted EPU Stresses

**Smallest alternating stress ratio 2.18**

**Conducted test at 1/8th scale**

- 1/8-Scale Model Testing (SMTs) predicted onset of Safety Relief Valve (SRV) acoustic resonance

**SMT results not used to define CLTP dryer loads**

[[  
(3)]]

- Test predicted an increase of [[
- (3)]]

## Conclusions

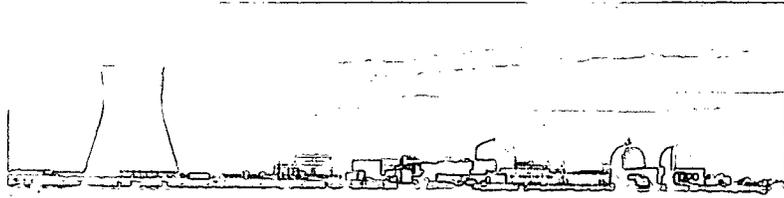
**MSL Strain Gage Data Shows a Relatively Quiet Plant.**

**ACM Revision 4 Used to Improve Load Predictions at Low Frequencies**

**FEM Performed with Harmonic Domain Methodology for More Accurate Results**

**Biases and Uncertainties Accounted for in ACM & FEM**

**Margin to Stress Limits at EPU Remains Greater Than 100%**



# Probabilistic Safety Assessment

E.T. Burns

PSEG Risk Management Team



# Probabilistic Safety Assessment

## Purpose of EPU Risk Evaluation

- Provide risk perspective regarding effect of EPU implementation
- Estimate change in Full Power, Internal Events CDF and LERF produced by EPU implementation
- Identify qualitatively changes in risk from other sources (e.g., external events and shutdown configurations) produced by EPU implementation
- Compare with RG 1.174 for risk significance of change

# Probabilistic Safety Assessment

## Risk Evaluation Process Overview

- EPU submittal based on deterministic evaluation of licensing criteria, i.e., not a risk-informed submittal.
- Regulatory Guide 1.174 provides quantitative measures that provide risk perspective on EPU submittal.
- Quantitative risk metrics chosen by NRC in RG 1.174 are Core Damage Frequency (CDF) and Large Early Release Frequency (LERF).
- RG 1.174 acceptance guidelines consider both initial values and magnitude of changes in CDF and LERF as a result of proposed changes.

# Probabilistic Safety Assessment

## Risk Evaluation Methods

- Identify plant configuration and procedural changes
- Use updated PRA models
- Identify those PRA elements affected by changes
- Incorporate hardware and procedure changes in PRA model
- Use realistic success criteria and limits
- Calculate risk metrics ( $\Delta$ CDF,  $\Delta$ LERF)
- Compare results with Reg. Guide 1.174 Guidelines

# Probabilistic Safety Assessment

EPU Changes	Possible PRA Elements Affected
<b>Power Level</b>	<b>Success Criteria (Depressurization, ATWS overpressure)</b> <b>HRA (Allowed Timing)</b> <b>System Fault Trees (SORV probability / Challenges)</b> <b>Level 2 (Core Melt Progression Timing)</b>
<b>Configuration Changes</b>	<b>HRA</b> <b>System Fault Trees</b> <b>Initiating Events (Reduced Margin)</b>
<b>Hardware Changes</b> <ul style="list-style-type: none"> <li>▫ Physical Changes</li> <li>▫ Reliability changes (bounding)</li> </ul>	<b>System Fault Trees</b> <b>Data (including Initiating Events)</b>
<b>Procedural changes</b>	<b>HRA (Time available and EOP limits)<sup>(1)</sup></b> <b>Success Criteria</b>
<p>(1) Changes in time to cues based on RPV water level, PSP, HCTL, BIIT.</p>	

# Probabilistic Safety Assessment

## Hope Creek PRA Model Scope and Quality

- Internal Events PRA developed in accordance with ASME PRA Standard to meet Capability Category II
- Industry Peer Review conducted November 1999
- PRA Model extensively modified in 2003 to resolve all recommendations (i.e., F&Os)
- PRA self-assessment against ASME PRA Standard Addendum B June 2006 confirms 92% of Supporting Requirements meet Capability Category II<sup>(1)</sup>
- External Events and Shutdown Conditions addressed, but not quantified (only scoping studies available)
  - Assessed to be very small contributors to change in risk associated with EPU implementation

<sup>(1)</sup> Capability Category II is expectation for PRAs to support risk informed submittals.

# Probabilistic Safety Assessment

EPU PRA Changes	ASME PRA Element
Modified Initiating Event Frequency to reflect potential for increased challenges due to reduced margins (e.g., %flow margin)	IE
Slight change in system success criteria (RPV Depressurization, ATWS over pressure, modified number of SRV challenges)	SC
No significant impact due to hardware changes (e.g., replaced "in-kind" with like equipment), however, modified SORV probability	SY
No new accident sequences identified	AS
Reduced time available for crew diagnosis and execution	HR
No significant impact due to procedural changes (HCTL, PSP, BIIT changes are assessed as negligible)	HR

# Probabilistic Safety Assessment

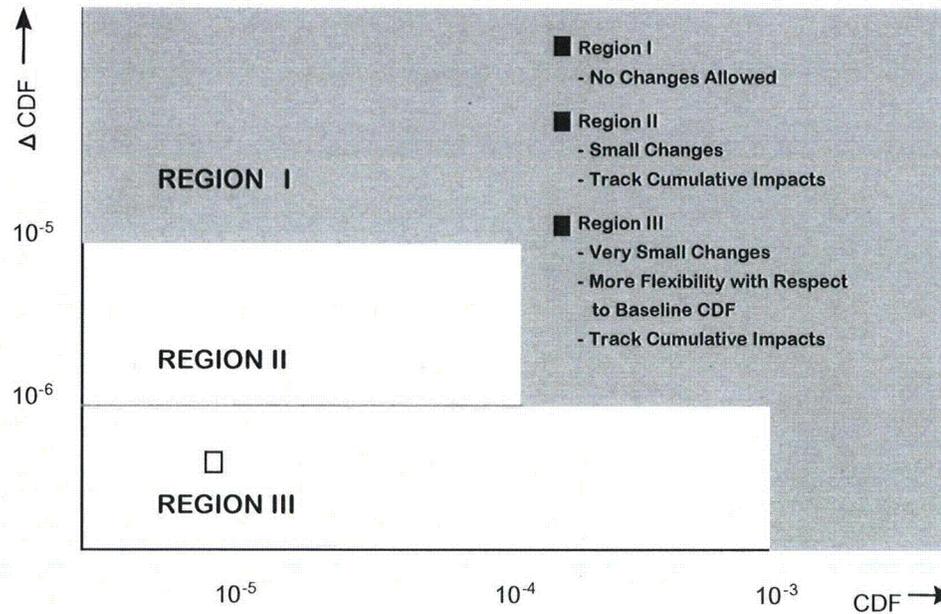
## Summary Comparison

### Baseline (CLTP) and Updated (EPU) CDF and LERF for Hope Creek Internal Events Model

Risk Metric	CLTP	EPU	Change in Risk Metric	RG 1.174 Risk Characterization
CDF	9.42E-06	1.01E-05	6.8E-07	Very Small
LERF	2.37E-07	2.98E-07	6.1E-08	Very Small

# Probabilistic Safety Assessment

## Acceptance Guidelines for CDF

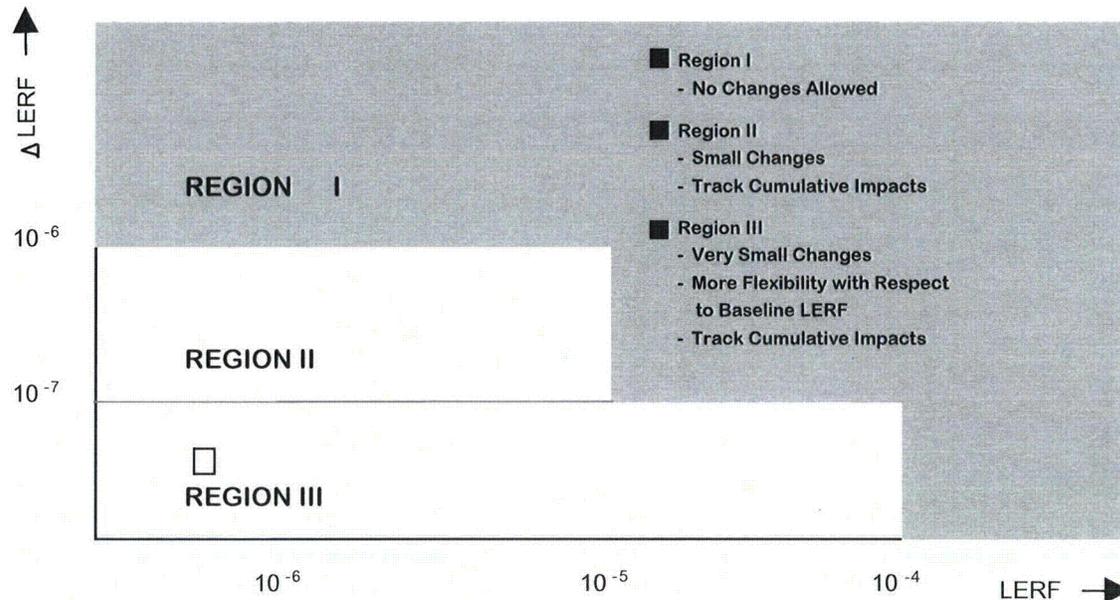


□ Upper bound estimate of CDF change for power uprate

Acceptance Guidelines for Core Damage Frequency (CDF)  
(Uses HCGS Level 1 and 2 PRA for Internal Events)

# Probabilistic Safety Assessment

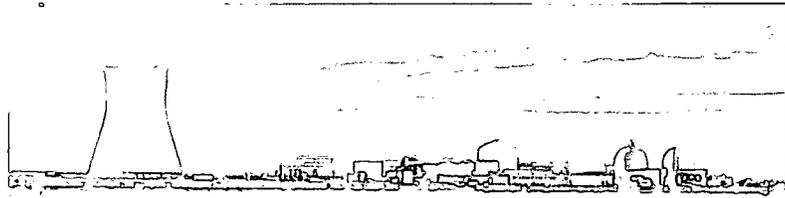
## Acceptance Guidelines for LERF



Acceptance Guidelines for Large Early Release Frequency (LERF)  
(Uses HCGS Level 1 and 2 PRA for Internal Events)

## Summary of EPU Risk Impact

- Risk impact was evaluated using standard PRA methods (quantitative and qualitative)
- Quantified risk impact is a small percentage of current plant risk
- $\Delta$ CDF is a very small risk change per Reg. Guide 1.174
- $\Delta$ LERF is a very small risk change per Reg. Guide 1.174
- Risk impacts from external events and shutdown conditions are either negligible or minor



# Grid Reliability

Paul Davison

Site Engineering Director



## PJM Planning Requirements

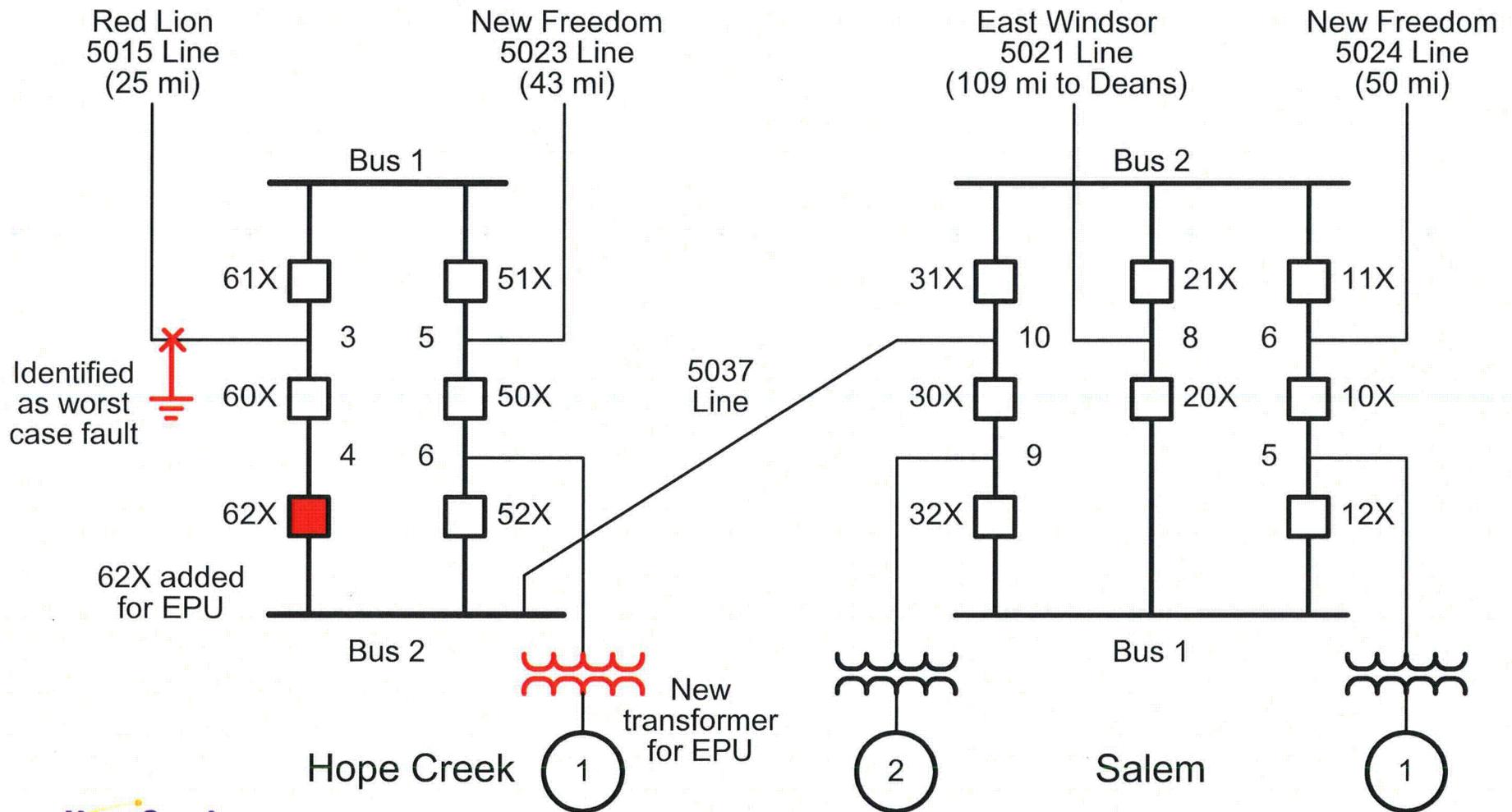
- Hope Creek operates within PJM Interconnection
- PJM members required to follow FERC approved Regional Transmission Expansion Planning (RTEP) process
  - Feasibility Study
  - System Impact Study
  - Generation Interconnection Facilities Study
  - Interconnection Service Agreement (ISA) - FERC Docket ER05-815-001

## PJM System Impact Study for Hope Creek

- Met all Criteria except MAAC Criteria IV Stability Requirements
  - System stability maintained without loss of load during and after:
    - A. Three-phase fault with normal clearing time.
    - B. Single phase-to-ground fault with delayed clearing.
    - C. Loss of any single facility with no fault.
  - Results: Unstable for single-line-to-ground fault at Hope Creek on 500 kV Hope Creek-Red Lion 5015 line with stuck bkr 3-4 (60X).
- Modification: Breaker 2-4 (62X) subsequently added in series with breaker 3-4 (60X) as part of EPU Design Change Package to resolve and comply with Criteria IV

# Electrical Grid Reliability - Addition of Breaker 62X

## PSEG Nuclear Hope Creek and Salem 500 kV Switchyards



## Artificial Island Operating Guide Updated for EPU

- Interconnection Facilities Study performed and results documented in Artificial Island Operating guide (AIOG)
- One, two, and three unit operation
  - 3805 MW max. supplied by Artificial Island with 1320 MW from Hope Creek
- Power System Stabilizers (PSS) in and out-of-service
  - PSS provides input to regulators to damp small-signal oscillations.
- Trip-A-Unit Scheme enabled and disabled
  - Selective tripping of Salem Unit 1 or 2 improves system stability by reducing power transfer over critical lines after severe transmission contingencies

## **Electrical Grid Reliability - Summary**

**Increased power output studied in accordance with FERC approved PJM planning process.**

**Reliability maintained by real-time contingency analysis tools and load dispatching within stability limitations**

## Hope Creek Safety Relief Valve (SRV) Performance

### Set Points:

- 4 @ 1108 psig, +/- 3%, (1074.8 – 1141.2 psig)
- 5 @ 1120 psig, +/- 3%, (1086.4 – 1153.6 psig)
- 5 @ 1130 psig, +/- 3%, (1096.1 – 1163.9 psig)

### T.S. Change:

- Amendment 115 – April 1998
- 1% to 3% Tolerance

# Hope Creek SRV Performance

## SRV Changes:

- BWROG Recommendations Implemented
  - Stellite-21 Pilot Valve upgrade (all 14 valves)
  - Improved maintenance practices for seat lapping

## SRV Performance (post-1998):

- Cycle 9 - 2 Failures (+7.8%, +3.1%)
- Cycle 10 - 3 Failures (+4.6%, +5.5%, 8.6%)
- Cycle 11 - 8 Failures (+3.1%, +3.8%, +4.0%, +5.0%, +5.3%, +5.8%, +6.3%, +7.5%)
- Cycle 12 - 5 Failures (+3.6%, +4.3%, +4.8%, +5.5%, +6.8%)
- Cycle 13 - 3 Failures (+3.2%)

----- Modification Implemented

- Cycle 14 - 0 Failures

## Hope Creek SRV Performance

### ASME Over-Pressure Protection:

- **Bounding analysis performed in support of the SRV Set Point Tolerance change from 1% to 3%**
  - One non-functioning SRV and
  - Balance of SRVs assumed set point of 1250 psig
  - Result – 1331 psig (Bottom Head)
  - 44 psig margin to ASME Upset Limit of 1375 psig
- **Low-Low Set feature of “H” & “P” SRVs is not credited**
  - Safety Related, Activated at 1047 psig
  - Auto pressure control: H – 1017 to 905 psig, P – 1047 to 935 psig

## Hope Creek SRV Performance

### Conclusion:

- SRV Performance Deficiencies Recognized
- Active participation with Industry Users Group (BWROG)
- Modifications Implemented in 2006
- Initial results favorable – 0 Failures
- Low-Low Set Down Not Credited and provides Margin
- Bounding analysis performed

## Hope Creek ECCS Pump Performance

**LP Unavailability: Top Quartile – 0.43 %**

**HP Unavailability: Top Quartile – 0.53 %**

**Quarterly IST Results – Acceptable Performance  
No Increased Frequency Testing**

# Power Ascension Test Matrix

% Power	MSL Strain Gage	Moisture Carryover	MSL Accel	SRV Accel	FW Accel	Ext Steam Accel	Recirc Accel	Non Critical FIV	Rad Survey	Core Perform	Chem Data	FW Run-Out	DEHC Press Change	Sys Perf Mont	FW Level Step Change
90	X	X	X	X	X	X	X			X		X	X	X	X
100	X	X	X	X	X	X	X			X		X	X	X	X
101	X		X	X	X	X	X								
102	X		X	X	X	X	X								
102.5	X	X	X	X	X	X	X							X	
103.5	X		X	X	X	X	X								
104.5	X		X	X	X	X	X								
105	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
106	X		X	X	X	X	X								
107	X		X	X	X	X	X								
107.5	X	X	X	X	X	X	X							X	
108.5	X		X	X	X	X	X								
109.5	X		X	X	X	X	X								
110	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
111	X		X	X	X	X	X								
111.5	X	X	X	X	X	X	X			X				X	
111.5 CF	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
112.5	X	X	X	X	X	X	X								
113.5	X		X	X	X	X	X								
114.5	X		X	X	X	X	X								
115	X	X	X	X	X	X	X			X				X	
115 CF	X	X	X	X	X	X	X	X	X	X	X	X		X	

# MSL Performance Criteria (Limit Curves)

[[

(3)]]

# FIV Performance Criteria (Level 1)

Table 4-1 - EPU FIV Recorded Values

Inside Drywell	Node	Acceptance Criteria			Actual Recorded Values			Actual values divided by acceptance criteria %		
		g-rms			g-rms			X%	Y%	Z%
		X <sub>g</sub>	Y <sub>g</sub>	Z <sub>g</sub>	X <sub>g</sub>	Y <sub>g</sub>	Z <sub>g</sub>			
MS A 26" vert riser, 154'	14	0.584	-----	0.490		-----				
MS B, 26" vert riser 140'	490	-----	0.296	0.234	-----					
MS B, 26" horiz run by SRVs	460	0.474	0.265	0.383						
MS B, 26" by venturi	534	0.323	0.343	-----			-----			
MS A 26" by MSIV, 107'	81	0.438	0.635	-----			-----			
MS A, SRV "J" disch	22J	0.518	-----	0.298		-----				
MS B, SRV "P" disch	40P	1.013	0.121	0.633						
MS A, RCIC line	430	-----	1.342	0.969	-----					
FW DW, 24" by valve	50	0.420	0.555	0.525						
FW DW, 24/12 reducer to "C"	160	0.828	0.893	-----			-----			
FW DW, 12" "A"	220	0.557	1.248	-----			-----			
FW DW, 12" "B"	280	0.438	-----	0.145		-----				
FW DW, 12" "C"	Z002	0.468	1.559	0.352						

# Moisture Carryover Performance Criteria

Performance Criteria Not to be Exceeded	Required Actions if Performance Criteria Exceeded and Required Completion Times
<p><u>Level 2:</u></p> <ul style="list-style-type: none"> <li>• Moisture carryover exceeds 0.1%</li> </ul> <p style="text-align: center;">-OR-</p> <ul style="list-style-type: none"> <li>• Moisture carryover exceeds 0.1% and increases by &gt; 50% over the average of the three previous measurements taken at &gt; 3339 MWt</li> </ul>	<ol style="list-style-type: none"> <li>1. Promptly suspend reactor power ascension until an engineering evaluation concludes that further power ascension is justified.</li> <li>2. Before resuming reactor power ascension, the steam dryer performance data shall be reviewed as part of an engineering evaluation to assess whether further power ascension can be made without exceeding the Level 1 criteria.</li> </ol>
<p><u>Level 1:</u></p> <ul style="list-style-type: none"> <li>• Moisture carryover exceeds 0.30%</li> </ul>	<ol style="list-style-type: none"> <li>1. Promptly initiate a reactor power reduction and achieve a previously acceptable power level (i.e., reduce power to a previous step level) within two hours, unless an engineering evaluation concludes that continued power operation or power ascension is acceptable.</li> <li>2. Within 24 hours, re-measure moisture carryover and perform an engineering evaluation of steam dryer structural integrity. If the results of the evaluation of dryer structural integrity do not support continued plant operation, the reactor shall be placed in a hot shutdown condition within the following 24 hours. If the results of the engineering evaluation support continued power operation, implement step 3 below.</li> <li>3. If the results of the engineering evaluation support continued power operation, reduce further power ascension step and plateau levels to nominal increases of 41 MWth and 83 MWth, respectively, for any additional power ascension.</li> </ol>