

**NUCLEAR REGULATORY COMMISSION**

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Thermal-Hydraulic Phenomena Subcommittee  
Duane Arnold Energy Center Power Uprate  
Request

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

September 27, 2001

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1 UNITED STATES OF AMERICA  
2 NUCLEAR REGULATORY COMMISSION

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4 ADVISORY COMMITTEE ON REACTOR SAFEGUARDS  
5 THERMAL-HYDRAULIC PHENOMENA SUBCOMMITTEE MEETING  
6 DUANE ARNOLD ENERGY CENTER POWER UPRATE REQUEST

7 + + + + +

8 THURSDAY

9 SEPTEMBER 27, 2001

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11 ROCKVILLE, MARYLAND

12 + + + + +

13 The ACRS Thermal Phenomena Subcommittee  
14 met at the Nuclear Regulatory Commission, Two White  
15 Flint North, Room T2B3, 11545 Rockville Pike, at 1:00  
16 p.m., Dr. Graham Wallis, Chairman,  
17 presiding.

18 COMMITTEE MEMBERS PRESENT:

19 DR. GRAHAM WALLIS, Chairman

20 DR. F. PETER FORD, Member

21 DR. THOMAS S. KRESS, Member

22 DR. DANA POWERS, ACRS Cognizant Member

23 DR. VIRGIL SCHROCK, ACRS Consultant  
24  
25

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1 ACRS STAFF PRESENT:

2 PAUL A. BOEHNERT, ACRS Staff Engineer

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

(1:00 p.m.)

CHAIRMAN WALLIS: The meeting will come to order. This is a continuation of yesterday's meeting of the ACRS Subcommittee on Thermal-Hydraulic Phenomena. I am Graham Wallis, the Chairman of the Subcommittee, and I will immediately hand the meeting over to Dana Powers, who is the Cognizant Member for this meeting.

DR. POWERS: Thank you, Professor Wallis. We are going to go quickly through the staff's version of this application for a power uprate from Duane Arnold this morning.

And at the conclusion of the presentations, I am going to walk around the membership to discuss two things. First, their reactions to what they have heard; and second of all, trying to develop some guidance both to the staff and to the applicant on what they should think about presenting to the full subcommittee in support of our subcommittee report.

To the extent that the members have thoughts as the presentation goes along, I hope that they will send me notes so that I can start assembling something of an agenda, and some idea of how long it

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1 will take.

2 My opening feeling here is that right now  
3 the central issues that will be of interest to the  
4 full committee are the PRA results and the code audit  
5 results from the staff, but that is just my initial  
6 impression at this point.

7 I think we did have some open items left  
8 over from yesterday's presentation by the applicant,  
9 and I will ask Ron if he has anything that he would  
10 like to touch on just to fill us in.

11 MR. MCGEE: Good morning. This is Ron  
12 McGee of NMC. Yesterday, there were a few questions  
13 that we looked up some material from yesterday. The  
14 first was dealing with the scaling factors associated  
15 with our stress calculations, and with that, I will  
16 turn the discussion over to Al Roderick.

17 MR. RODERICK: I am Al Roderick, with NMC,  
18 at the Duane Arnold Energy Center. The question was  
19 where the 12-1/2 percent increase, the scaling factor  
20 came from for the main closure flange, even though it  
21 is a constant pressure power uprate.

22 I talked with the people that did the  
23 detailed work, and in addition to normal operation,  
24 they also look at all the transients that are applied,  
25 and then the most limiting one is used to determine

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1 the scaling factor.

2 So, in fact the turbine trip transient  
3 event pre-EPU showed an 8 degree temperature change  
4 during that event, and the analysis after, or when we  
5 are considering EPU conditions, showed a 9 degree.

6 So that ratio, going from 8 degrees to 9  
7 degrees, is a 12-1/2 percent increase. So we are  
8 talking about a very small number, and it was  
9 following the simple, straightforward, considerative  
10 methodology in calculating that ratio.

11 CHAIRMAN WALLIS: Wait a minute. I am  
12 concerned here because it is supported with 9.2  
13 degrees, and as I remember, your number went up to  
14 pretty close to the limit. You went up from -- I have  
15 to look at the numbers.

16 Well, from 68 to 77 and the limit was 80.  
17 So I now have to worry, and if you are saying that one  
18 degree is worth this change, then was it 1.0 or 1.1,  
19 or 1.2 degrees. What accuracy are we talking about  
20 here? That is the cause of it.

21 MR. RODERICK: This is a very conservative  
22 methodology that is being used to verify code  
23 compliance, and the conservative scaling factors were  
24 determined following their methodology looking at EPU  
25 evaluations.

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1 And the scaling factor was applied to the  
2 current calculated stress, and the EPU stress MEDCO  
3 allowables, and that satisfied the acceptance  
4 criteria. So no further detailed work was needed.

5 CHAIRMAN WALLIS: Well, you understand my  
6 point. You are saying 8 went up to 9, and that's 12-  
7 1/2 percent, and one degree is 12-1/2 percent. We are  
8 talking about 77,364, which is an accuracy of one part  
9 in about 77,000.

10 And I would have to worry that if your  
11 reason is that it went from 8 to 9, maybe it went from  
12 7.9 to 9.1, which would take you over the limit of  
13 80,000.

14 So I think we need to have something in  
15 writing that is more rigorous. I'm sorry, but it just  
16 doesn't sound good enough, unless the committee wants  
17 to override me on that, but that is my opinion. Dr.  
18 Ford is an expert on materials.

19 DR. FORD: Well, that was my first  
20 reaction. That is a source of the 12 percent.

21 MR. WU: Good morning. I will try to  
22 answer the questions. You have to understand that I  
23 am the reviewer on these parts as a matter of fact.

24 MR. BOEHNERT: Can you identify yourself,  
25 please, sir.

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1 MR. WU: Okay. My name is John Wu.  
2 According to the methods, if we have some increase,  
3 like a transient in temperature or flow, or pressure  
4 transient, normally you do -- you know, you develop  
5 the factor, the scaling factor.

6 Then usually the scaling factor multiplies  
7 the -- and the -- actually, if you say the temperature  
8 increases by one degree, which means you increase  
9 probably only -- well, only thermal, and that  
10 increases by 12.5 -- and actually this choice  
11 including seismic and all other LOCA.

12 And now because of these conservative  
13 measures, you must multiply by the -- and the upper  
14 multiplication after you multiply by that is then  
15 allowable, and then we say, okay, we will not go any  
16 further.

17 So actually 12.5 is only -- you know,  
18 because of the scaling factor, is very conservative.  
19 But it is the thermal stress -- that is only part of  
20 that.

21 CHAIRMAN WALLIS: I think that must be  
22 right. It can't be that the thermal stress is this  
23 entire 77,000 psi.

24 MR. WU: No.

25 CHAIRMAN WALLIS: So the thermal being 12-

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1 1/2 percent can't be the whole story.

2 MR. WU: Right.

3 CHAIRMAN WALLIS: Now, what we need is a  
4 solid written explanation.

5 MR. WU: Probably they need -- it is  
6 detailed, but this is the way they do it. They  
7 multiply whatever the change is, and the change is  
8 where you have the scaling factor, and you multiply it  
9 by the -- and you are including the thermal pressure  
10 and everything in there.

11 CHAIRMAN WALLIS: So I think this could be  
12 resolved by a written communication of some sort.

13 MR. WU: Yes.

14 CHAIRMAN WALLIS: Thank you.

15 MR. WU: And confirmation of it.

16 DR. POWERS: Ron, did you have any other  
17 points that you wanted to make?

18 MR. MCGEE: Not at this time. Oh,  
19 concerning other questions left open from yesterday?

20 DR. POWERS: That's right.

21 MR. MCGEE: There was questions concerning  
22 H202 monitoring post-LOCA, and with that, I will turn  
23 the discussion over to Steve Huebsch.

24 MR. HUEBSCH: The first thing is that  
25 there was a question -- oh, this is Steve Huebsch,

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1 NMC. There was a question about the five percent  
2 limit, I believe that was in the write-up.

3 Do you want me to go through all of that,  
4 or did you want to specifically tailor the question to  
5 --

6 CHAIRMAN WALLIS: Well, the five percent -  
7 - maybe the staff can do it. My comment simply was  
8 that in reading the SER the explanation seemed turgid.  
9 I just wanted a clear explanation, and maybe the staff  
10 will give that to us today.

11 MR. HUEBSCH: Well, I can go through that  
12 real quickly if that was the intent, and the five  
13 percent limit is out of the regulation for oxygen  
14 limit. Duane Arnold is a Mark-I containment. It is  
15 a nitrogen inerted containment.

16 So as part of EPU, we looked at the  
17 hydrogen-oxygen generation rates, and predominantly  
18 because of the EPU, you saw that your increases were  
19 from two factors. One was an increase in generation  
20 because of radiolysis, and the second one had to do  
21 with the redesign of the fuel, the GE-14 fuel.

22 So those were the two main factors that  
23 changed the rate of generation. Duane Arnold monitors  
24 oxygen content in order to keep the flammability  
25 limits, because with the nitrogen containment, the

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1 hydrogen needs an oxygen component to reach there.

2 So in looking at the analysis, we  
3 identified that because of these two methods that we  
4 would reach that 5 percent oxygen limit by about a day  
5 sooner than we did prior to EPU.

6 So one of the things that we did was that  
7 we have a containment atmosphere dissolution system  
8 that we use to mitigate that concern, and the CAD  
9 system on site had the capacity to increase the  
10 quantity or the mass of nitrogen in the system to be  
11 able to maintain that oxygen limit below five percent  
12 for the duration of the seven days as required by the  
13 standard.

14 So we increased the mass retention in that  
15 system in order to keep the oxygen limits below the  
16 five percent from roughly 2.3 days into the event to  
17 the 7 day mark.

18 The other issue with the oxygen --  
19 hydrogen-oxygen monitors that is in the write-up deals  
20 with the heat trace that we have installed. Our heat  
21 trace lower limit is 200 degrees, and so the heat  
22 trace cycle is roughly between 200 and 215 degrees.

23 And from a conservative nature, we looked  
24 at that, and what we know is that our monitors are --  
25 they read conservatively high when the drywall or

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1 containment temperatures are above the heat trace  
2 temperatures.

3 So what we have done is that in the  
4 submittal, we have identified that the containment  
5 hydrogen/oxygen monitors will not meet the  
6 requirements of Reg Guide 197, and the NUREG 0737 for  
7 the first period of time until drywall temperatures  
8 come down.

9 However, they will be operable. They will  
10 be reading a little bit high. But we will be able to  
11 use them for trending, and we will be able to monitor  
12 things.

13 Since we don't have any actions taken for  
14 roughly 2.3 days, we felt that a 24 hour change in the  
15 commitment prior to meeting the requirements of the  
16 Reg Guide 197 accuracies was appropriate.

17 And as I said, we still have them, and we  
18 will be able to turn them on and we will be able to  
19 use them for monitoring and trending of the generation  
20 rates, such that the control room operators will be  
21 able to figure out when they are going to have to take  
22 appropriate mitigation steps.

23 CHAIRMAN WALLIS: So they don't meet the  
24 requirements, but it is at a time when they are not  
25 needed. Therefore, you made that argument, and does

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1 the staff accept that argument?

2 MR. MCGEE: Is anyone here from the  
3 containment systems branch?

4 MS. MOZAFARI: Well, I just wanted to let  
5 you know --

6 DR. POWERS: I don't think we are ready  
7 for you yet.

8 MS. MOZAFARI: Well, I wanted you to know  
9 that the containment systems, if you are going to ask  
10 about the containment systems and analysis, the staff  
11 is on a holiday today.

12 CHAIRMAN WALLIS: That's why they invited  
13 us down here, right?

14 MS. MOZAFARI: The containment systems  
15 staff, it is a religious holiday, and they were not  
16 able to make it today.

17 CHAIRMAN WALLIS: I see. Okay.

18 MS. MOZAFARI: We talked to Paul about the  
19 possibility of either tomorrow morning or presenting  
20 actually in the full committee the results of the  
21 analysis. So I just wanted to let you know that. I  
22 am Brenda Mozafari, the project manager for the  
23 licensing for Duane Arnold.

24 MR. BROWNING: I think we understand what  
25 Duane Arnold did. We need to understand how the staff

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1 looked at that.

2 CHAIRMAN WALLIS: And why it is  
3 acceptable, yes.

4 DR. POWERS: That's right. Ron, do you  
5 have any other points?

6 MR. MCGEE: Not at this time. Thank you.

7 DR. POWERS: Okay. Thank you, Ron. Okay.  
8 We will now turn to the presentations by the staff,  
9 and Brenda, you are going to provide us an  
10 introduction on this?

11 MS. MOZAFARI: Right. As I said, by way  
12 of introduction, my name is Brenda Mozafari, and I am  
13 the Duane Arnold licensing project manager for NRR.  
14 And you did receive the draft safety evaluation --

15 MR. BOEHNERT: Excuse me, Brenda, but you  
16 need to speak in the mike.

17 MS. MOZAFARI: You did receive the draft  
18 safety evaluation and I guess I want to emphasize that  
19 it was draft. We felt that it would not have been a  
20 good thing to postpone the ACRS again for purposes of  
21 tieing it up in a nicer packaging once we became  
22 pretty convinced that our evaluation was complete,  
23 with a few things still left to tie up at the end.

24 I think that we want to present here today  
25 the basis for the draft safety evaluation, recognizing

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1 that there were formatting and wording errors, and  
2 matters left to resolve. But we felt that they were  
3 at least close to closure, and the staff is going to  
4 present their evaluation.

5 The containment analysis portion, as I  
6 said, is going to be addressed later, but I believe  
7 that George Hubbard was going to be here today if  
8 there were any general questions.

9 And I want to give you the order of  
10 presentation. Ralph Caruso, who is the section chief  
11 of reactor systems, is going to speak first on the  
12 reactive core fuel performance area.

13 Then John Wu will discuss material  
14 degradation issues, and he will be supported by  
15 members of the materials engineering staff who are  
16 here to support him.

17 Then we will do the PRA review and ATWS  
18 response, and Donald Harrison is here to present that,  
19 and Dick Eckenrode is going to provide additional  
20 information on the human factors portion.

21 We do have two open issues at the time of  
22 the draft safety evaluation. They have to do with  
23 start-up testing, and I will give you a brief summary  
24 of where we are on that, and the NPSH issue that was  
25 left to open.

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1 And Kerry Kavanaugh is going to discuss  
2 that. And then we will give some overall concluding  
3 remarks at the time. So I am going to turn it over to  
4 Ralph at this time.

5 DR. POWERS: Let me ask one question. At  
6 what point do we discuss grid stability?

7 MR. CARUSO: I'm sorry?

8 DR. POWERS: At what point do we discuss  
9 grid stability?

10 MR. CARUSO: Grid stability?

11 MS. MOZAFARI: Well, we don't have a  
12 specific presentation on grid stability. We could  
13 make people available at the end of the discussion to  
14 discuss that.

15 DR. POWERS: Okay.

16 DR. SCHROCK: I have one point that I  
17 would like to bring up and that is something that is  
18 not on the agenda here, and concerning LOCA  
19 evaluation.

20 I think that the presentations so far have  
21 indicated that the increase in the peak clad  
22 temperatures is very modest, and that there is a huge  
23 gap remaining between the peak clad temperature and  
24 the 2200 degree limit.

25 But I was reminded that the SAFER method

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1 application under SECE -- I think 472 was the number -  
2 - resulted in a 1600 degree limitation being imposed.

3 And so I think the wrong impression has  
4 been conveyed and I think that ought to be clarified.  
5 So where do we really stand with regard to what is the  
6 existing peak clad temperature limit in LOCA for Duane  
7 Arnold.

8 And what was it previously under the old  
9 license provision, and what would it be under the  
10 extended power uprate? So I think that another look  
11 at the comparison of those numbers is really in order.

12 MR. CARUSO: This is Ralph Caruso from the  
13 reactor systems branch. This was discussed quite a  
14 bit yesterday I thought by GE when they explained  
15 under the SAFER/GESTR methodology that licenses have  
16 to meet both the 1600 limit and the 2200 limit.

17 And I don't have the actual numbers here,  
18 but they provided the pre-and-post power uprate peak  
19 clad temperatures for both of those aspects of the  
20 methodology, and showed that the numbers did not  
21 change significantly, I believe, either one of them.

22 I guess I am not clear. Dr. Schrock, what  
23 your question is.

24 DR. SCHROCK: Okay. Perhaps I am the only  
25 on here that had this impression of the results as

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1 presented. Both in the meeting yesterday and in the  
2 previous meeting on this topic, there was discussion  
3 about the large range above the predicted peak clad  
4 temperatures which is available.

5 And it was presented in the sense that  
6 2200 is the applicable limit, and 2200 is the  
7 applicable limit in Appendix K and that is true. But  
8 you have also imposed the 1600 degree limit for this  
9 particular licensing methodology.

10 And also it was mentioned that, yes, there  
11 are some plants that do in fact have predicted peak  
12 clad temperatures close to the 2200 degree limit. But  
13 in fact those plants are not analyzed by this method.

14 So what I am saying, Ralph, is that I  
15 think this is a matter which was presented in an  
16 unclear way, and I am asking for clarification. Now,  
17 if I am the only one that sees it that way, fine, it  
18 doesn't need any. I will then have to ask my  
19 colleagues if I alone in this?

20 MR. CARUSO: Let me see if I can explain  
21 it again. They have not just one limit of 1600, but  
22 they have to meet both the 1600 according to the upper  
23 bound calculation; and they have to meet 2200 by the  
24 licensing basis calculation.

25 They do essentially two sets of

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1 calculations, and they have to meet both of those  
2 criteria. They cannot just meet one or the other.  
3 They have to meet both, and they have to demonstrate  
4 that they meet both.

5 DR. KRESS: Would you remind us of the  
6 reason for the 1600 degree limit?

7 MR. CARUSO: The 1600 degree limit came  
8 because the data that was used to support the  
9 methodology did not include tests that went above the  
10 1600 degrees.

11 DR. KRESS: So that was the basis then?

12 MR. CARUSO: So that was the reason for  
13 the limit. Recently, GE has asked us to relax that  
14 limit because they have some new data, and we are  
15 considering that.

16 But right now the methodology, and  
17 methodology comprises a lot of different parts, but  
18 the methodology does include both an upper bound  
19 calculation to show that they meet the 1600 limit,  
20 plus an Appendix K type calculation to show that they  
21 meet the 2200 limit. So they have to meet both of  
22 those.

23 CHAIRMAN WALLIS: And the nomenclature of  
24 upper bound is a little bit confusing, because it is  
25 actually the lower one.

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1 MR. CARUSO: Right, and I understand that.

2 MS. ABDULLAHI: If I may interject. I am  
3 Zena Abdullahi, of the reactor systems. And I just  
4 want to say that the Duane Arnold numbers -- and I  
5 think that GE and Duane Arnold can expand on it, but  
6 that the 2200 limit for Duane Arnold for the GE14 fuel  
7 is 1510, and which is the limiting, and it is 1350 for  
8 the 1600 limit, or less than 1350.

9 CHAIRMAN WALLIS: That's what we had  
10 yesterday, and it was one of the unnumbered slides.  
11 It is useful that they have numbers so that we can  
12 refer to them.

13 MR. CARUSO: Right. I guess I am not sure  
14 that I have answered your question, Dr. Schrock.

15 DR. SCHROCK: Yes, I think you have.

16 MR. CARUSO: Okay. Good morning. My name  
17 is Ralph Caruso, and I am the Chief of the BWR Nuclear  
18 Performance Section in the Reactor Systems Branch of  
19 the NRR, and I am going to talk this morning about the  
20 fuel and the reactor systems review that was done for  
21 the Duane Arnold power uprate.

22 I would like to start by giving you a bit  
23 of background. This power uprate was not just an  
24 increase in power for the Duane Arnold plant. It also  
25 included a change in fuel to GE14, which is one of

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1 GE's newest fuel lines.

2 And it also included a change in the power  
3 to flow map to use what is called MELLLA operation, M-  
4 E-L-L-L-A, maximum extended load line limit analysis  
5 method, which is needed in order to be able to get to  
6 the higher power level.

7 However, I wanted to make it clear before  
8 I start, and I will say this several times throughout  
9 my presentation, that even though the power limit was  
10 -- that the power will be changed at Duane Arnold, we  
11 are making no changes to the fuel burn up limits.

12 BWR fuel is licensed to a certain burn up  
13 limit, and that limit has not changed. And in  
14 addition licensing limits have not changed as a result  
15 of this.

16 So Duane Arnold has to demonstrate -- and  
17 we believe that they have demonstrated that they meet  
18 those licensing limits for this power uprate.

19 DR. POWERS: To be clear on this, it seems  
20 to me that it is also true that the staff has made an  
21 engineering judgment that at the license burn up limit  
22 on the fuel that the fuel will tolerate the ATWS  
23 transients, and that that has not been demonstrated by  
24 experiment.

25 But that a research program has been

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1 initiated to try to confirm that regulatory decision.

2 MR. CARUSO: I believe that is a fair  
3 statement to make, Dr. Powers. The review scope, we  
4 looked at the core, the fuel performance, reactivity  
5 characteristics, and all the aspects that we would  
6 look at during the normal review of this sort of  
7 scope.

8 We used as a template for this review the  
9 ELTR-1, ELTR-2, and the supplement to ELTR-2, that  
10 were reviewed and accepted by the staff earlier, about  
11 5 or 6 years ago, for power uprates.

12 The analyses in the evaluations that were  
13 done by Duane Arnold and by GE are based on NRC  
14 approved methodologies, analytical methods, and codes,  
15 including the acceptance criteria that are described  
16 in those methods.

17 Because this was a rather large power  
18 uprate, we decided that we would include on-site  
19 audits as part of our review. Duane Arnold was the  
20 first plant that we had done this for for a power  
21 uprate.

22 I am going to report that we found the  
23 process to be quite positive and useful, and we intend  
24 to continue to do it. We looked at the safety  
25 analyses, and the performance evaluations that were

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1 prepared by GE and by the licensee.

2 And we determined whether they complied  
3 with analytical methods and codes that I have  
4 discussed earlier, and we used the EPU safety analysis  
5 report, NEDC-32980, as the guideline for this.

6 CHAIRMAN WALLIS: How does this audit  
7 work? Do you look over their shoulder while they ran  
8 a calculation or is it a formal process where they are  
9 on one side of the table and you are on the other?

10 MR. CARUSO: No, we send a team, usually  
11 4 to 5 people, to the offices where the information is  
12 located, and GE has different parts of their  
13 organization doing different parts of their analyses,  
14 either in Wilmington or San Jose.

15 And what we do is that we look at what has  
16 come in, and we look at what we have looked at  
17 recently, because we take history into account; the  
18 history at other plants, and the history in other  
19 reviews.

20 And we say to ourselves where do we think  
21 there are areas where we maybe don't feel comfortable,  
22 but where we would like to look. And we target those  
23 particular areas, and we say, okay, licensee, where is  
24 this information located.

25 And then we send a team of 4 or 5 people

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1 out there, and they will say that I want to look at  
2 the design record files for the ATWS analysis for this  
3 plant.

4 And at this point in the review those  
5 analyses should already be completed. There should be  
6 a set of analyses that has been reviewed, approved,  
7 quality assured, and documented. And we ask for those  
8 design record files.

9 And this team of people will sit down in  
10 a room for a day or two, and jus read, and think, and  
11 read, and think. And at the end of a few days, they  
12 have questions.

13 And they go to the GE people and say I  
14 don't understand this, and where did this come from.  
15 Why did you make this assumption. Can you document  
16 for me that the operators will take this particular  
17 action.

18 CHAIRMAN WALLIS: Like a Ph.D. defense.

19 MR. CARUSO: That is the idea, and because  
20 the experts are right there, these audits are  
21 particularly effective. They can ask the question and  
22 they can get an answer right away. So that is the way  
23 that we do them.

24 A lot of this is background about what the  
25 criteria are,. and in the standard review plan,

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1 Section 4.2, that talks about fuel system design  
2 criteria for AOOs, and I believe that the criteria is  
3 that during AOOs that 99.9 -- 99.9 and not 99.99 --  
4 percent of the fuel will not undergo transition  
5 boiling.

6 That damage would not prevent control rod  
7 insertion, et cetera, et cetera, et cetera. GE has a  
8 methodology that has been approved to ensure that  
9 analyses of AOOs demonstrate that they meet this  
10 criteria. That is what we looked at.

11 In addition, the vendors perform thermal  
12 mechanical, thermal hydraulic, and neutronic analyses  
13 of the fuel to ensure that it meets the design limits  
14 that are specified as part of the fuel licensing  
15 criteria.

16 The fuel licensing criteria are another  
17 set of or is another document which allows the vendors  
18 to design fuel, to build it, and to use it in  
19 reactors. So we review the application of these  
20 methodologies to the plant in question, and in this  
21 case, Duane Arnold.

22 DR. POWERS: Is this the appropriate point  
23 to ask about the COBRA-G evaluation of GE14 fuel?

24 MR. CARUSO: I'm sorry, the COBRA-G?

25 DR. POWERS: The COBRA-G, yes.

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1 MR. CARUSO: I will get into that in a  
2 second.

3 DR. POWERS: Okay.

4 MR. CARUSO: I am still to a certain  
5 extent in background here, and I am going to try and  
6 move along. The thermal limits evaluation for Duane  
7 Arnold was performed using what is called an  
8 equilibrium core.

9 They will establish an operating condition  
10 that is expected to occur after a certain number or  
11 reloads, where the plant is essentially operating in  
12 a steady state mode.

13 It has completely been loaded with the  
14 particular type of fuel, and in this case, GE14 fuel,  
15 and it is operating from one cycle to another cycle at  
16 the -- how do I want to say this -- the term is the  
17 equilibrium core.

18 And which is the state that you reach  
19 after you load the same type of fuel using the same  
20 core design parameters over a number of cycles, and  
21 eventually reaching an equilibrium state in terms of  
22 core design. And once again operation -- considering  
23 the MELLLA rod line and the 20 percent power uprate.

24 One thing that I would like to mention is  
25 that although these analyses were done for an

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1 equilibrium core, thermal limits are established or  
2 confirmed for every individual reload, because you  
3 don't have the equilibrium core starting from the  
4 first core.

5 So GE or any other vendor, they do thermal  
6 limits analyses to verify that the core as designed  
7 and as installed meets those thermal limits. And they  
8 publish the results of those analyses in something  
9 called a cooperating limits report.

10 And very often they have to submit to us  
11 a techs spec change because they change a parameter in  
12 the tech specs called a safety limit minimum critical  
13 power ratio.

14 And we have actually done the review of  
15 that safety limit ratio for Duane Arnold. I think I  
16 signed it out the other day. And that is a number  
17 that varies between about roughly 1.09 and 1.12 or  
18 thereabout.

19 And the methodologies for establishing  
20 that number are well understood, and we do that review  
21 just about every cycle. And once again I want to make  
22 it clear that there are no changes to any burn up  
23 limits for this fuel.

24 A power uprate does not allow anyone to  
25 exceed currently established burn up limits.

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1 DR. POWERS: And I will hasten to add  
2 again that those are based on a judgment that they  
3 will in fact survive reactor transients.

4 MR. CARUSO: I understand that. I am  
5 trying to make this point as often as I can because  
6 some of the questions that have arisen imply, or  
7 actually state that, well, because you are going to do  
8 a power uprate that the fuel is going to be burned to  
9 a higher burn up value.

10 And I want to make it clear that that is  
11 not the case. The fuel may be burned faster and some  
12 of the fuel may experience a higher duty than it would  
13 otherwise see. But the actual burn up limits, the  
14 amount of gigawatt days per metric ton that you can  
15 get out of the fuel, has not changed.

16 DR. KRESS: The average has changed  
17 though?

18 MR. CARUSO: The average has changed, but  
19 the peak bundles, the bundles that are most limiting  
20 in these analyses, have not.

21 DR. KRESS: Yes, most limiting, in terms  
22 of the regulatory compliance with Chapter 15 DBAs.

23 MR. CARUSO: That's correct.

24 DR. KRESS: But when we think about PRAs  
25 and risk, we think about the average.

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1 MR. CARUSO: That's correct. The decay  
2 heat has indeed gone up. So there are some scenarios,  
3 for example, of shut down cooling, where there is less  
4 time available.

5 I believe there was a significant  
6 discussion about that yesterday, and that situation  
7 does exist. But for fuel licensing, those limits have  
8 not changed.

9 I have a lot of background here on  
10 stability. I don't want to spend a lot of time on it  
11 because we have talked about this quite a bit  
12 yesterday. Let me see if there is any slide here that  
13 I need.

14 CHAIRMAN WALLIS: Are you going to come  
15 back to this business of the up-skew and down-skew?

16 MR. CARUSO: I am going to get to that.

17 CHAIRMAN WALLIS: Okay.

18 MS. ABDULLAHI: Ralph, I think you passed  
19 that under the on-site audit.

20 MR. CARUSO: Let's see.

21 MS. ABDULLAHI: You have to excuse us. It  
22 is not numbered.

23 MR. CARUSO: I thought I had a slide in  
24 here that talked about that, and I was going to be  
25 getting to that.

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1 MS. ABDULLAHI: I think you passed it  
2 already, Ralph.

3 MR. CARUSO: I did?

4 MS. ABDULLAHI: The staff EPU audit, and  
5 it is right after fuel design and operations.

6 CHAIRMAN WALLIS: That's the one that I am  
7 looking for.

8 MR. CARUSO: Oh, okay.

9 CHAIRMAN WALLIS: That is the one that you  
10 kept saying that you were getting to, and you left it  
11 behind.

12 MR. CARUSO: I'm sorry. You know what?  
13 I think it mis-fed through the feeder, and I don't  
14 have that slide as a slide. Okay. What I did -- I  
15 have the printouts here, but I have a set of slides,  
16 and I think maybe it got double-fed. So I didn't get  
17 a copy of that one. So I don't have a slide for that  
18 one. But I can talk from it.

19 One of the reviews that we looked at, one  
20 of the areas that we looked at during the review was  
21 the fuel system design. In this case, for GE12 and  
22 GE14 fuel.

23 And during the course of the review, we  
24 discovered that GE had used some data that was  
25 generated by a code known as COBRA-G to be included a

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1 database for a correlation that is known as GESTR-14.  
2 I think it may have been known as GESTR-10 at the  
3 time.

4 And as part of the review, we actually get  
5 into the details of these correlations. We look at  
6 the data, and we say where did this data come from.

7 We can look at the quality assurance for  
8 it. And in the case of this one particular heat  
9 transfer correlation, the staff discovered that some  
10 of the data did not come from a test facility, but  
11 came from a computer code.

12 And we questioned that, and we held some  
13 pretty intense discussions with General Electric about  
14 this. And in the end, we convinced them that they  
15 should not use this data. And as a result, what they  
16 have done is that they have backed it out of their  
17 database, and they have revised their correlation.

18 And they have followed their procedures in  
19 their corrective action plan to revise the correlation  
20 and redo assessments or calculations as necessary to  
21 reflect those changes. It is the same sort of thing  
22 that they would do if they discovered an experimental  
23 data was not correct.

24 So as I say in this slide, we believe that  
25 they are taking appropriate action. They have taken

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1 appropriate action, and we think that this issue is  
2 resolved for Duane Arnold.

3 Yesterday though I received -- actually in  
4 this room, very room, I received GE's submittal from  
5 Glen Wattford who is sitting somewhere in the back  
6 there, with new information about this correlation.

7 And the staff will be reviewing it. They  
8 have gone out and they have additional data available  
9 that they had not used in this correlation.

10 They have decided now to use that data,  
11 and they made a staff submittal, and the staff will  
12 review it. But I want to point this out because this  
13 is an example of the sort of information that we have  
14 discovered as a results of this on-site audit that we  
15 would not necessarily see as part of an in-office  
16 audit, for example, or a review in the office. So  
17 that is one of the successes of this.

18 CHAIRMAN WALLIS: I think it is also good  
19 that they have submitted a document, and I think we  
20 often get uneasy when a matter is resolved by a  
21 promise to take appropriate action, and we don't have  
22 a process for checking that it has actually happened.

23 MR. CARUSO: Well, I will leave it at  
24 that, and I will agree. I think in this case that GE  
25 and the licensee have been very cooperative. We have

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1 honest technical disagreements, and honest differences  
2 of opinion on this.

3 But in the end, we convinced them that our  
4 position was the correct one, and they have processes  
5 to deal with this, and they followed them. Let's see.  
6 What else.

7 DR. POWERS: What I did not see in the  
8 discussion in the SER was the adequacy and  
9 applicability of the data that were accepted by the  
10 staff, especially with respect to power profile.

11 MR. CARUSO: That actually gets treated as  
12 part of the methodology. They have to take  
13 uncertainty penalty factors. If you don't have enough  
14 data to support a particular profile, then you have to  
15 take a penalty factor for that. And that is in the  
16 methodology.

17 One of the questions that has come up  
18 about these power uprates is margins, and who owns the  
19 margin. I think there was a discussion about that --  
20 was that this morning. No, yesterday.

21 DR. POWERS: Well, I think it is not only  
22 a discussion that took place yesterday, but it is a  
23 discussion that has taken a long time, and I think  
24 that everybody at the table agrees. So I would  
25 suggest that you just move on.

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1 MR. CARUSO: Fine. Stability. As I said,  
2 Duane Arnold is a 1-D plant and they do detectance,  
3 suppress --

4 DR. POWERS: Let's be clear. 1-D does not  
5 mean that they are one dimensional.

6 MR. CARUSO: That's correct.

7 DR. POWERS: In fact, they are a multi-  
8 dimensional plant, and 1-D is an option corresponding  
9 to the ATWS.

10 MR. CARUSO: They are an Option 1-D plant,  
11 and the solution to the stability issue for Duane  
12 Arnold involves implementation of Option 1-D. As part  
13 of the on-site review, the staff discovered a document  
14 which questioned the applicability of the generic  
15 Divom curve.

16 The Divom curve is -- and I am going to  
17 need help on this at some point if you get too much  
18 into the details, but it is the delta CPR over initial  
19 CPR, versus oscillation magnitude curve, and it is a  
20 generic curve which is supposed to be applicable to  
21 all BWRs, which is an input to the on-line stability  
22 monitoring systems.

23 And during the review the staff discovered  
24 an internal GE document which questioned whether the  
25 existing Divom curve was applicable or appropriate for

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1 plants. And this also applied to any plant that used  
2 GE14 fuel.

3 And as a result, GE has issued a Part 21  
4 report on this Divom curve, and the number of plants -  
5 - all the BWRs in the country are in the process of  
6 responding to that Part 21 notice by either taking  
7 corrective action to go back to interim manual  
8 corrective actions, where they have on-line stability  
9 monitoring systems for the use of interim conservative  
10 versions of the Divom curve.

11 This is an ongoing process, and let me see  
12 if I have the slide here.

13 CHAIRMAN WALLIS: So actually the core-  
14 wide oscillation is one-dimensional isn't it?

15 MR. CARUSO: No, I don't want to say that.  
16 It is core-wide. I don't know that I would say that  
17 that is one-dimensional.

18 CHAIRMAN WALLIS: Okay.

19 MR. CARUSO: Okay. As I say here, GE  
20 discovered that the generic regional mode Divom curve  
21 is strongly affected by the peak bundle power, and  
22 there may be some plants operating with high peak  
23 bundle powers, where the Divom curve did not consider  
24 that they could be operating.

25 GE has recommended that licensees use a

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1 particular figure of merit to determine whether they  
2 have a problem in this area. For Duane Arnold, that  
3 particular figure of merit is such that the Divom  
4 curve for Duane Arnold continues to be appropriate.  
5 I don't believe that they will have to change their  
6 Divom curve.

7 So for Duane Arnold, this is a resolved  
8 issue. For a number of other plants though,  
9 additional calculations will have to be done, and this  
10 is being done under the egis of the BWR Owners' Group.

11 And yesterday, or two days ago, excuse me,  
12 they presented us with a plan for redoing the  
13 calculations and redeveloping the Divom curves. And  
14 that plan takes into consideration individual plants'  
15 needs and fuel that will be loaded into the plants,  
16 and I believe it has completion date of sometime late  
17 next year.

18 The staff will be receiving a submittal  
19 sometime in the late second quarter of next year, and  
20 hopefully we will complete our review by the end of  
21 the next calendar year.

22 This is another example of an issue that  
23 we discovered as a result of an audit that we would  
24 not have otherwise have found.

25 CHAIRMAN WALLIS: What is the basis of

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1 this Divom curve?

2 MR. CARUSO: I am going to ask for help on  
3 that.

4 MS. ABDULLAHI: GE should address that in  
5 this case.

6 MR. POST: This is Jason Post of GE.  
7 Their TRAC-G calculations is a fully coupled  
8 calculation, and each peak of a growing oscillation  
9 produces an oscillation magnitude, and TRAC directly  
10 calculates CPRs.

11 So you have a CPR change versus an  
12 oscillation magnitude, and we normalize those factors  
13 to produce the Divom curve.

14 CHAIRMAN WALLIS: So it is an entirely  
15 theoretical --

16 MR. POST: Yes, it is theoretical, and of  
17 course TRAC-G has been used to benchmark actual  
18 instability events, and so we are pretty confident  
19 that it does a good job of doing that.

20 CHAIRMAN WALLIS: Oh, it has been  
21 benchmarked against oscillatory events?

22 MR. POST: Yes. Yes, it has.

23 DR. POWERS: Were there others?

24 MR. POST: There were some KLL specific  
25 tests that we benchmarked, and there was another event

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1 in Cofrontaes (phonetic) that was an unplanned event  
2 that we benchmarked.

3 There were also some earlier events at  
4 Caruso in Italy. So there were a number of overseas  
5 events that we benchmarked.

6 MR. CARUSO: Jens, did you want to say  
7 something?

8 MR. ANDERSON: This is Jens Anderson.  
9 Yes, I just wanted to make a comment, but I think  
10 Jason made most of the comments, and there have been  
11 a fairly extensive qualifications basis.

12 Maybe one additional point that I would  
13 like to make is on oscillatory testing, and ATWS  
14 capability --

15 MR. CARUSO: Okay. As part of all of  
16 these reviews of fuel, the staff also considered the  
17 operability of the supporting systems. For example,  
18 the ECCS system, the RCS system, the recirculation  
19 system, to make sure that these systems are not  
20 operating outside their design basis, and could  
21 provide appropriate support to the reactor so to  
22 speak.

23 So this was part of the standard review,  
24 and we did not identify any particular operation of  
25 any of these systems that would call into question

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1 operation at the higher power level.

2 It should be noted that some of these  
3 analyses will continue to be rerun throughout the life  
4 of the plant as the core reloads change, and as the  
5 limiting transients and accidents change through the  
6 life of the plant.

7 So even though we have done this review at  
8 this point, and the licensee has documented their  
9 analyses, those analyses continue through the life of  
10 the plant.

11 One of the audit calculations that we  
12 looked at was the ECCS analyses for Duane Arnold. We  
13 looked at the methodology of SAFER/GESTR, and the  
14 results, and we didn't discover any problems. It was  
15 clean.

16 One of the systems that I think people  
17 have been concerned about has been the standby liquid  
18 control system because of its importance to the ATWS  
19 scenario. Standby liquid control is a manually  
20 operated system.

21 The license confirmed to us that it can  
22 actuate, and it can inject the required amount of  
23 boron into the system when called upon to do so. We  
24 believe that they have demonstrated that the SLC  
25 system would be able to inject the required amount of

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1 boron into the reactor vessel during an ATWS.

2 This is a conclusion concerning reactor  
3 transients, and just a description of the fact that  
4 they did do the analyses, and they will reanalyze them  
5 and reconfirm the results for every particular reload,  
6 and they used approved methods, and the results met  
7 the acceptance criteria.

8 For ATWS, they met the ATWS mitigation  
9 features. 10 CFC 50.62 specifically requires the  
10 installation of alternate rod insertion, and reactive  
11 recirc pump trip, and standby liquid control boron  
12 injection capability, and they meet those  
13 requirements.

14 One of the questions that the ACRS asked  
15 was whether there should be an automatic standby  
16 liquid control system installed. In looking at this  
17 matter, my recommendation at this point is, no, I  
18 don't want it.

19 And we have identified a scenario which --  
20 well, I don't want to overstate this because we are  
21 just in the very early stages of looking at this. But  
22 if the standby liquid control system initiates too  
23 soon during a transient, there could be difficulties  
24 that are caused by actuation too soon because of the  
25 way that the system is piped, and the way the relief

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1 valves in the system are installed.

2 So automatic actuation of the standby  
3 liquid control system is something that would need to  
4 be considered very carefully.

5 CHAIRMAN WALLIS: Well, if it is done too  
6 soon, it could be programmed not to do it too soon.  
7 And you have the same problem with an operator doing  
8 it too soon.

9 MR. CARUSO: That's correct.

10 CHAIRMAN WALLIS: And between the operator  
11 and the automatic, it is not really based on having  
12 discovered a new scenario.

13 MR. CARUSO: Well, actually, if you do it  
14 automatically, you have to think about the timing, and  
15 what sort of signals cause the actuation.

16 Operators are not as reliable as automatic  
17 actuation systems. They take a while to react and to  
18 respond, and we hope that they think about what they  
19 are doing. So there is a certain amount of delay  
20 there.

21 But we are reluctant at this point to say  
22 that there should be an automatic standby liquid  
23 control system actuation. I'm sorry, a question?

24 AUDIENCE: What defines too soon? Is it  
25 10 seconds, 5 seconds? Does anybody have a feel for

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1       that?

2                   MR. CARUSO: Well, looking at the pressure  
3       traces, it looks like it is within five seconds or so  
4       after the initiation or the detection. I believe  
5       there is a signal called an ATWS alarm, or a ATWS  
6       signal, that occurs.

7                   And I don't think you would want to have  
8       the standby liquid control system initiate off of that  
9       particular signal. I don't want to get into this in  
10      too much detail because it is something that we just  
11      recently discovered, and we have not thought about it  
12      very much.

13                  DR. POWERS: I would like to go back to  
14      your existing recovery, and recommended recovery  
15      process for an ATWS. The strategy of dropping the  
16      core level and injecting boron, and bringing the  
17      coolant level back up was developed considering a  
18      particular core power profile that was common at the  
19      time that the strategy was developed.

20                  We don't have that particular power  
21      profile now in the plant. The collapse liquid level  
22      is actually being dropped down below the top active  
23      fuel in this strategy.

24                  How does the revised power profile that is  
25      being envisioned for Duane Arnold and the power uprate

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1 affect that strategy?

2 MS. ABDULLAHI: I think that GE would like  
3 to make a response to this issue, and then I would add  
4 if need be.

5 MR. POST: This is Jason Post. The  
6 dissolution was originally developed, including  
7 MELLLA, and if you take a recirc pump -- the impact of  
8 MELLLA is that Duane Arnold could operate at 99  
9 percent of their new rated power, or I'm sorry, a  
10 hundred percent of their new rated power at 99 percent  
11 flow.

12 Previously, any plant with MELLLA could  
13 operate at the point corresponding to 105 percent  
14 power uprate at 81 percent of their license flow. So  
15 those are an equivalent rod line, and if you take a  
16 pump trip from either one of those two cases.

17 And a flow run back to the natural  
18 circulation point, you end up at very close to the  
19 same power level, because it is really controlled by  
20 what the rod pattern, and that is what sets the power  
21 level at the end of the run back.

22 DR. POWERS: You will be stunned at how  
23 little of which you just said I understand.

24 MR. POST: Sorry about that.

25 DR. POWERS: I got all the articles, but

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1 none of the nouns in there. It didn't make any sense  
2 to me at all.

3 MR. POST: We had a power flow map up  
4 yesterday.

5 MS. ABDULLAHI: If I can interject and  
6 maybe if it would be of any help, in the ATWS  
7 stability generic analysis that were done, they were  
8 based on certain powers, and certain power densities,  
9 and rod lines.

10 And the power, for instance, that they  
11 were based on if I recall -- and it is seen in a table  
12 called 5-1, it was 33233138, and that power level  
13 compared to Duane Arnold is higher.

14 And then if you look at the power density,  
15 it seemed high, and whether Duane Arnold's now would  
16 be higher than this, I can't confirm right now. But  
17 just to give you an idea that these bounding analyses  
18 could have had some basis that covers it.

19 DR. POWERS: I think what you are telling  
20 me is that the analyses were done for plants with much  
21 higher power than what Duane Arnold plans to go to  
22 originally.

23 The issue, of course, is how about the  
24 power density in the froth region, or two-phase  
25 region?

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1 MS. ABDULLAHI: I would also have Tony  
2 Ulises intervene as well.

3 MR. ULSES: This is Tony Ulises of the  
4 staff. Actually, if I understand your question, Dr.  
5 Powers, you are really questioning the effect of  
6 lowering the water level to down low and whether or  
7 not these new operating strategies would affect any of  
8 the assumptions that went into the acceptance of that  
9 original philosophy.

10 Is that the question really that you are  
11 asking?

12 DR. POWERS: That is basically the  
13 question. My recollection is that when the strategy  
14 was originally proposed the staff resisted the concept  
15 of bringing the collapsed water level down below the  
16 top of active fuel.

17 We had a particular power level in that  
18 phase region for those discussions. Now we have a  
19 different one, and does it change the discussion.

20 MR. ULSES: This basically goes into the  
21 concept of what is called the minimum steam cooling  
22 reactor water level, which is basically what we say  
23 you can go down to, and you will still have enough  
24 flow of steam to keep the upper portion of the fuel  
25 cool.

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1 And if you look at how that was generated  
2 -- and if I get off-base here, Jason, let me know.  
3 But what I recall is that that was actually calculated  
4 with an extremely conservative top peak axial power  
5 distribution, which is even larger than what they are  
6 going to go to with these modern reactor operating  
7 strategies.

8 So therefore they will still be covered by  
9 the existing minimum steam cooling reactor water  
10 level, and so that will still be applicable.

11 DR. POWERS: Is this the result of an  
12 analysis, or is this the result of your impromptu  
13 speculation?

14 MR. ULSES: This is the result of a  
15 calculation that was done quite a bit of time ago. I  
16 believe it was like in the '80s or the '70s as I  
17 recall when this original concept was originally  
18 developed.

19 MR. POST: The mid-1980s.

20 MR. ULSES: The mid-1980s, and it has been  
21 used ever since in the ATWS operating strategies.

22 DR. POWERS: I am quite sure that you have  
23 not -- that you did not anticipate in that calculation  
24 what Duane Arnold was going to do with their power  
25 profile.

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1 MR. POST: This is what I was trying to  
2 say earlier. Right now at their extended power uprate  
3 with the MELLLA line, Duane Arnold could go between 99  
4 percent and a hundred percent of rated flow.

5 Previously, if they would have had MELLLA  
6 at this power level, they could have operated it at  
7 this point, which would be 81 percent of their flow.  
8 These two points are on the same rod line.

9 So if you take a pump trip from that  
10 point, or a pump trip from this point if they had  
11 operated with MELLLA, both of those pump trips would  
12 run down to the same point at natural circulation, and  
13 basically at that point right there.

14 So both conditions end up there, and since  
15 plants had MELLLA when we developed that solution  
16 originally, we were modeling a condition that is the  
17 condition that Duane Arnold is moving to today for  
18 their application.

19 DR. POWERS: Thank you.

20 MR. CARUSO: I guess that's all I have to  
21 say about reactor and fuels. If you have any  
22 questions, I am available, or we can go on to the next  
23 presenter.

24 DR. POWERS: Do the members have any  
25 additional questions they would like to ask about

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1 reactor fuels? If not, I think we can go on.

2 MR. WU: My name is John Wu from NRR, and  
3 I am here today for this material degradations.  
4 Actually, this material degradations is mostly  
5 materials and parts, and it seems that my part is the  
6 flow induced vibration is one of the issues that has  
7 come out.

8 So that's what I am here for. And so that  
9 is what I am going to cover, is this topic, and others  
10 related to corrosion and erosion I will give to the  
11 material people over there.

12 And first of all, we start with the  
13 reduced power uprate, and I think that this flow  
14 induced vibration mostly was covered by GE yesterday,  
15 and so I will just quickly go through this and take  
16 any questions if there is any.

17 This power uprate mostly -- while the  
18 reactor pressure has no change, there is no change on  
19 temperature, and no change on the flow rates, or core  
20 flow rate.

21 And also there is no or very little change  
22 in the drive flow because we generated more steam, and  
23 we have a bigger pressure drop. So the drive flow is  
24 increased a little, which I understand is 2.5 percent.

25 And mostly we have a steam flow increase.

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1 So because there is no core flow increase, and if you  
2 look at the component inside of the reactor affected  
3 by the core flow, such as the guide chip, et cetera,  
4 those become -- and also the in codes, they are the  
5 code -- like the fuel banding, they are not affected.

6 But only a few components are affected,  
7 like the drive flow at 2.5, which is very minimal.  
8 But GE have been varying those based on their recorded  
9 data.

10 And the results come up to the results  
11 that the vibration level is below the acceptance  
12 limits. That is the acceptance limits of -- they have  
13 vibration -- you know, they can monitor and the  
14 calculation illustrates the vibration stress level,  
15 which is less than the endurance limits. That is what  
16 GE put on it as being the criteria.

17 And based on that the endurance limits are  
18 acceptable, and anything in other components -- you  
19 know, every component, if their vibration is less than  
20 endurance limits, and it means that they are not  
21 getting into the picture of a particular calculation,  
22 because the fatigue factor -- the cumulative factor,  
23 or the cumulative fatigue usage factor is not required  
24 in the design basis, and is zero, and it is below the  
25 acceptable limits.

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1           And as a matter of fact, in the GE  
2           submittal, they put acceptable -- for 10 KSI, but that  
3           is very conservative compared to ASME 13.6 KSI. So,  
4           7.6 KSI if you look at the fatigue curve in the ASME,  
5           you will see that corresponding to about 10 to the  
6           11th endurance limits.

7           So, therefore, in the upper -- steam flow  
8           affected by the increase of steam flow are the  
9           components of dryer and separator. I think that GE  
10          made a presentation yesterday that the dryer and the  
11          separator there are not -- they are not separate  
12          components, and that is mostly that they don't have --  
13          for that.

14          But since we asked the question how is  
15          this affected by flow induced vibration, they look at  
16          their data for the separator, and the separators data,  
17          the data for the separators, the data shows that the  
18          vibration acceptable level is about 15 percent of the  
19          acceptance limits.

20          CHAIRMAN WALLIS: We heard yesterday that  
21          there were cracks observed in these devices. So it is  
22          acceptable for some things, but you have --

23          MR. WU: There is no crack on the  
24          separator, but the dryer, in the dryer, they did find  
25          some, and they also looked at the dryer.

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1 DR. FORD: Did you during the analysis  
2 -- and I recognize that they are not safety related  
3 components as such, but in relation to what was  
4 discussed yesterday by GE, they are not safety related  
5 components, the dryers and separators.

6 If they did fail either by stress  
7 corrosion cracking in the channel, in the bottom of  
8 the dryer, or by fatigue of the vains in the dryer,  
9 and they came lose, how would that affect the overall  
10 safety of the reactor as such, and was that evaluated?

11 MR. WU: Yes, we also asked the questions,  
12 asked GE the same question about it. The design  
13 criteria, as such, the dryer has to stay intact, and  
14 structure integrity has to be maintained.

15 During a pipe break, or during the steam  
16 line break because worrying about the dryer, goes to  
17 the steam dryer, and -- you know, it stops the  
18 operation, and so that has to be calculated to ensure  
19 that structural integrity of this dryer.

20 And also because the power uprates, we  
21 evaluate those to meet the design basis, and we  
22 approve in the ELTR-1 and ELTR-2.

23 CHAIRMAN WALLIS: I guess my comment went  
24 to the consequences of these things failing, and you  
25 are telling us that the consequence that you worry

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1 about is the pieces go down the steam line?

2 MR. WU: Yes, that is what a design  
3 criteria --

4 CHAIRMAN WALLIS: Could they not go around  
5 in the --

6 MR. WU: No, the flow induced vibrations  
7 is what you are talking about.

8 CHAIRMAN WALLIS: Where do the pieces go  
9 when they break?

10 MR. WU: Well, there is no problem with  
11 that. We still try to ensure integrity during  
12 operation, and such as like -- well, I think GE looked  
13 at similar plant, and they didn't find a crack on this  
14 dryer.

15 CHAIRMAN WALLIS: I think the problem that  
16 we are all having is regardless of what the codes say,  
17 there have been failures by stress corrosion cracks  
18 and flow induced vibration in the steam dryer  
19 separator units.

20 MR. WU: I am not sure it is from the flow  
21 induced vibration.

22 CHAIRMAN WALLIS: Well, regardless of  
23 whether it is flow induced vibration, or whether it is  
24 stress corrosion cracking, they failed, regardless of  
25 what the codes say.

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1 MR. WU: Yes, they failed.

2 CHAIRMAN WALLIS: And so actually the  
3 codes don't really mean much as far as maintaining  
4 integrity, and the question we are asking from a  
5 safety point of view is if these things come lose,  
6 what do they do?

7 MR. WU: So that is why we are looking at  
8 if those things come lose or will come lose, and if  
9 not, then we don't have to worry about it. So that is  
10 -- well, we look at what are the reasons for the dryer  
11 to fail or crack.

12 I think that what GE found out was that  
13 the crack was due to turning the turbine off, and  
14 closure, and the flow trenching, like the TSB closure,  
15 and --

16 CHAIRMAN WALLIS: I still have trouble  
17 relating the answer to the question.

18 MR. WU: Well, that is what I am trying to  
19 address. The crack is not due to -- well --

20 MR. KNECHT: This is Don Knecht from GE  
21 here. Let me try to add some clarification here.  
22 There is a couple of points. One is the cracks have  
23 been found in the dryer assemblies have all been  
24 identified early enough that they can be repaired so  
25 that they don't become a lost part during the upcoming

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1 cycles.

2 And so there has never been a case where  
3 there has actually been a lost part from these  
4 components. Now, if it did happen for some reason,  
5 the cracking is generally in the lower part of the  
6 dryer where the conditions are more conducive to  
7 stress corrosion cracking or vibration fatigue.

8 And failures in that location are going to  
9 stay below the dryer and not reach out in that area  
10 and into the steam line. They are not -- unless they  
11 are very, very small, they are not going to drop back  
12 through the separator under the conditions where we  
13 have low power, and we are shut down or what not.

14 And even if they did, they are not going  
15 to find their way all the way down into the fuel area  
16 where they will cause damage. So we have not done  
17 formal lost parts analyses on these, on the dryer  
18 pieces, at least not that I am aware of.

19 And the size -- well, the parts that might  
20 be lost because of this cracking are most likely large  
21 enough that they would not cause a problem and that  
22 would get out of the dryer area. So I hope that  
23 clarifies it.

24 DR. FORD: I don't know who to address the  
25 question to now, but there have been, for instance --



1 and still sticking to that one unit, there have been  
2 stress corrosion cracking of the brackets that hold  
3 the steam dryer assembly up.

4 What would happen -- those are not  
5 protected currently by --

6 MR. KNECHT: Correct.

7 DR. FORD: What would happen because of  
8 the general stressing nature, and increased by 31  
9 percent -- and I think that was the number that was  
10 given for the dryer, what would happen if you got a  
11 whole dryer that fell down?

12 And I recognize that would be an extreme  
13 event, but what would happen then? It wouldn't be  
14 just a small part. It would be a thumping great big  
15 component. Is that possible?

16 MR. KNECHT: Well, it only requires 3 out  
17 of the 4 support brackets to hold a dryer. So if  
18 there was cracking in one of them, that would be  
19 detected and repaired, and that would not be a  
20 problem.

21 Now, if for some strange reason you had  
22 multiple failures, the dryer would settle, and there  
23 would be a noticeable decrease in steam flow, and an  
24 immediate shutdown of unknown conditions.

25 DR. FORD: If it was laying on top of the

1 separator, it would just sit there?

2 MR. KNECHT: Well, you wouldn't have the  
3 steam flow that you would expect.

4 CHAIRMAN WALLIS: Would it make that much  
5 difference to the steam flow? Would it just be  
6 diverted, and increase the pressure drop, but that's  
7 not a significant component of the overall pressure  
8 drop is it?

9 MR. KNECHT: Well, normally it only has a  
10 very small pressure drop, but I think it would a flow  
11 blockage. But a complete one, of course, but it would  
12 be --

13 MR. WU: But this is for the same --  
14 according to their submittal, the occurrence occurs at  
15 the outer bank close to the impact nozzle, and -- is  
16 four times of that, and so there is no history of that  
17 for the Duane Arnold.

18 So, either there is no such thing, or is  
19 there no history for the -- is already 113 percent. So  
20 if we wanted to look at the operating experience, the  
21 cracking -- and we can ensure that it is okay. And  
22 here we are looking at flow induced vibrations to see  
23 if there is anything like that.

24 And there is no data and we looked at the  
25 dynamics of a pressure drop -- and it is about 10

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1 percent of the -- and so the flow increase 20 percent,  
2 and the vibration level increased 50 percent. So,  
3 that is 1.7 or about -- and so you can say that you  
4 can get some reasonable assurance --

5 CHAIRMAN WALLIS: You are saying that it  
6 is far from its endurance level?

7 MR. WU: It is far from their margin with  
8 respect to the dryer, yes. And the flow separators  
9 did not vary. The separator is about 15 percent  
10 according to their data -- and if it were to increase  
11 by 50 percent, you would have about 22 percent. So  
12 that is a big margin there, and because of this big  
13 margin, it gives us a good feeling about this.

14 CHAIRMAN WALLIS: Well, have they tested  
15 these dryers and separators at the specific conditions  
16 that they are going to be operated at with the power  
17 uprate in separate effects tests?

18 I think we asked that question yesterday,  
19 and I believe the answer was yes yesterday, and it  
20 seemed to be a very quiet yes. I mean, that's what I  
21 would to see.

22 I mean, flow induced vibrations; there are  
23 resonances and things that happen, and when you scale  
24 up this is based on some assumptions, and it is much  
25 more reassuring to say we have actually run this

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1 thing, and we have measured the vibrations under the  
2 conditions, and they are indeed small or some measure.

3 DR. FORD: I think maybe the question  
4 yesterday was asked in the context or at least a  
5 question was asked yesterday in the context of you  
6 extrapolating out, and do you have any data to bound  
7 that extrapolation, and that was in relation to the  
8 corrosion, and not the flow induced vibration.

9 CHAIRMAN WALLIS: Well, I meant flow  
10 induced in terms of vibration.

11 DR. FORD: Okay. But it was mentioned in  
12 relation to the flow assisted corrosion that this was  
13 a fairly low flow rate plant in comparison to the rest  
14 of the fleet.

15 So are there other reactors, and not Duane  
16 Arnold, out there which you have used in your  
17 evaluation to answer this question that Dr. Wallis  
18 asked? Is there data out there that would bound these  
19 flow rate conditions, or vibration conditions, in  
20 other plants?

21 MR. WU: In other plants such as -- well,  
22 Monticello and Hatch?

23 DR. FORD: Or whatever.

24 MR. WU: Yes, whatever, and GE has generic  
25 testing of up to 13 percent, or all the way up to 13

1 percent. So they are bounded by those.

2 DR. FORD: No, I think the question is are  
3 there data in other operating plants operating -- and  
4 it would be at these same flow rate conditions --  
5 which have been operating successfully. I mean, that  
6 is the question that is asked.

7 MR. WU: That is the question which --  
8 that is the data that we tried to get before, and for  
9 some reason we did not get it, because --

10 CHAIRMAN WALLIS: My question was somewhat  
11 different. I thought that these things were tested in  
12 separate effects tests. You test one separator and  
13 one dryer, and you can run that up way above what you  
14 get in the plant just to reassure yourself that you  
15 are extrapolating or interpolating.

16 But that would be nice to see and would be  
17 convincing, and it wouldn't just be -- and if you  
18 could show that everything is scaled, then that is  
19 fine, too.

20 But just to sort of extrapolate out there  
21 on the basis of a theory without any data to hang it  
22 on sounds a little bit dangerous.

23 MR. WU: I think they used to calculate  
24 that with the extrapolation of system data, and --

25 CHAIRMAN WALLIS: Maybe this could be

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1 answered before the full committee meeting or  
2 something. I am not sure we are getting an answer.

3 MR. SHUAIBI: This is Mohammed Shuaibi  
4 from the staff. If we can take that question back,  
5 maybe we can come back at the full committee and  
6 address it.

7 CHAIRMAN WALLIS: Maybe it would help if  
8 there were a written reply to the subcommittee before  
9 the full committee meeting so that we didn't have to  
10 go through trying to extracting the answer orally, and  
11 we could say, yes, we have read it and we think it is  
12 okay or not.

13 MR. SHUAIBI: We could certainly do that.

14 DR. FORD: The specific question is that  
15 given the fact that there have been flow induced  
16 vibration induced problems in dryers in the past are  
17 there any data, either in the laboratory or in full  
18 scale, or in the operating plant, which justifies that  
19 there will be no problem, and specifically at Duane  
20 Arnold.

21 CHAIRMAN WALLIS: That seems a simple  
22 question to answer.

23 MR. SHUAIBI: Justifies that there are no  
24 problems at Duane Arnold?

25 DR. FORD: Yes.

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1 MR. SHUAIBI: We will take that back.

2 MS. MOZAFARI: That justifies the  
3 assumption of no problems at Duane Arnold.

4 DR. FORD: Because saying you are adhering  
5 to the codes when there have been failures doesn't say  
6 too much about the code.

7 MR. SHUAIBI: We will take that back and  
8 we will provide an answer.

9 MS. MOZAFARI: Okay.

10 DR. POWERS: Let me ask a question on a  
11 different answer, but that is still related to  
12 materials and fatigue. The licensee has adjusted his  
13 methodology for looking at cumulative usage factors  
14 and in most cases saw a substantial drop in cumulative  
15 usage factors for fatigue.

16 In one case, however, he reports a fairly  
17 substantial increase in the cumulative usage factor,  
18 and in particular I believe for the feed water  
19 nozzles, I believe he shows a cumulative usage factors  
20 coming up very close to one.

21 Did the staff examine the methodology, and  
22 in particular did they look at the feed water nozzle  
23 issue?

24 MR. WU: The methodology that GE used is  
25 with respect to Appendix I in the ELTR-1. They said

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1 they followed Appendix I of ELTR-1, which we had  
2 approved before.

3 And the methodology says to compare the  
4 inputs parameters, and the EPU parameters, and to  
5 identify the inputs, and they don't have to do  
6 anything. And if it is not -- they have to do -- to  
7 get a scaling factor, conservatively based on whatever  
8 is -- well, the pressure temperature difference, and  
9 to come up with some scaling factor.

10 So they multiply the scaling factor and  
11 multiply by the existing stress and that ends up to be  
12 the -- and so the methodology that we approve, there  
13 are no problems. So because this is a scaling factor  
14 multiplied by the stress, the existing stress, the  
15 stress factor they use is really conservative.

16 So anything below 1.0 -- and as a matter  
17 of fact, we know that the stress is not limited to the  
18 -- it is the total stress, also including the others.

19 DR. POWERS: You are going an awful long  
20 way around the barn to answer what is a fairly simple  
21 question. What I want to know is did you look at the  
22 methodology, and I think the answer is yes.

23 MR. WU: Yes.

24 DR. POWERS: And how the question is did  
25 you look specifically at what they had done for the



1 feed water nozzles, and do you concur that the  
2 cumulative usage factor is less than one for that feed  
3 water nozzle.

4 MR. WU: Well, we did look at the details  
5 and their methodology.

6 DR. POWERS: That's all I needed to know.

7 MR. WU: Also, we looked at the details of  
8 some of the usage factors. I mean, there are lots.  
9 It is from .9 something way out to .199. And it goes  
10 down. So how come it goes down that much, and the  
11 answer we got is that in the past they used the worst  
12 condition, based on the worst condition.

13 And the worst condition is the loss of the  
14 feed water, and that is the worst, and from there they  
15 got -- let's say it is one, for instance, and from  
16 that they got the allowable cycle. And then they used  
17 the allowable cycle, which is normally small, and used  
18 or ate up all the cycles and that is too conservative.

19 So now they come back to do or to take for  
20 each one, and for each one it is a different transient  
21 for each transient, and maybe for 2 or 3, and after  
22 the three, they use that number three for the rest.

23 DR. POWERS: Well, it's just that I find  
24 it remarkable that everything drops down, and for  
25 understandable reasons. And here is one case where it

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1 goes up, and it seems logical that it should be a  
2 substantial fatigue for the feed water nozzle.

3 And it gets close to one and you don't  
4 check to see if you agree. I mean, it is within four  
5 percent of one. I can't or I myself cannot calculate  
6 cumulative usage factors up to four percent, but maybe  
7 other people can.

8 MR. WU: As I said with the feed water,  
9 the methodologies, we approved the methodology. So  
10 they used the methodologies, and we did review their  
11 detailed calculations.

12 MR. BROWNING: This is Tony Browning from  
13 Duane Arnold. The staff did request a number of  
14 summaries of the calculations in this area, and they  
15 were provided to the staff.

16 And while it wasn't the full set of the  
17 calculations, it was a fairly detailed summary of the  
18 calculations that the staff did review. And  
19 particularly one of the sets which was requested in  
20 the last RAI were the cases where we were showing  
21 ratios in the .98 and .99 range. So we did provide a  
22 summary of those calculations to the staff.

23 MR. SHUAIBI: Dr. Powers, Mohammed Shuaibi  
24 again. Would you like us to come back at the full  
25 committee and address that issue as well?

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1 DR. POWERS: I think what I am going to be  
2 asking you to do when you come for the full committee  
3 is to go through a little more discussion of the  
4 strategy for the review.

5 I think you may be a victim of trying to  
6 do this expeditiously, in which we posed a set of  
7 questions here, and you are responding to this  
8 specific set of questions, and really what we should  
9 have asked you for was the strategy for the review.

10 But in the course of doing that,  
11 understanding better where you are taking a  
12 methodology and asserting, yes, indeed we have  
13 approved this methodology in the case.

14 And then the specific thing of how much  
15 detail you go into in looking at how they apply it,  
16 might be a useful illustration for people. And this  
17 would not be a bad example, simply because it is such  
18 a striking example.

19 I think we can progress on to the next  
20 topic.

21 DR. FORD: Are we going to be talking  
22 about flow induced corrosion and stress corrosion?

23 MS. MOZAFARI: Right.

24 MR. CARPENTER: Good morning. My name is  
25 Gene Carpenter from the materials engineering branch,

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1 and I don't have any slides or overheads to give out  
2 today.

3 Basically, the staff had talked to the  
4 ACRS about the extended power uprate and how we did  
5 the reviews for boiling water reactors at a previous  
6 meeting, and to reiterate some of that information,  
7 the BWR VIP, the BWR vessel internals project, had  
8 provided a variety of reports for inspections and flow  
9 evaluations of the safety significant flow of BWR  
10 internals.

11 And those include the core spray systems,  
12 the core plate top guide, standby liquid control, the  
13 shroud supports, the BWR jet pumps, the LEPC system,  
14 the lower plenum components, the vessel interior  
15 diameter attachment welds, various instrument  
16 penetrations, and the reactor vessel itself.

17 We have reviewed each and every one of  
18 those inspection or flow evaluation guidelines, and we  
19 have approved them. And basically those allow us to  
20 have some assurance that the BWR licensees -- for  
21 instance, this licensee -- will be doing adequate  
22 levels of inspections to ensure that there are no  
23 degradations that will occur before they will be able  
24 to see them. There are no significant degradations.  
25 Does that answer your question?

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1 DR. FORD: Well, I have another specific  
2 item. All of the VIP reports related to stress  
3 corrosion cracking, both the disposition and result,  
4 and inspection period and methods, were based on data  
5 which was obtained in general with very, very low flow  
6 rates.

7 So even below that which are currently  
8 used in non-power uprated plants. What would be the  
9 rationale for saying that they should be necessarily  
10 applicable to power uprated plants operating at a much  
11 higher flow rates?

12 When you are doing this evaluation and  
13 applying the VIP documents, what went through the  
14 examination process in your mind to say that, yes,  
15 those VIP documents are applicable to these different  
16 environmental conditions?

17 MR. CARPENTER: Well, again, as you  
18 mentioned here, dealing with the various flow regimes,  
19 and that is what John was just talking about, with  
20 flow induced vibrations and he will come back to you  
21 and talk about that to some greater extent. So I will  
22 leave that to his further response.

23 We are obviously looking at the  
24 chemistries, and as you may remember from your  
25 previous life prior to the ACRS, BWRs have some fairly

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1 stringent chemistry controls in place, and even more  
2 so today than they did even 10 years ago.

3 We were also looking at the overall events  
4 from a systems point of view. We also look to some  
5 extent from the risk management point of view, and  
6 those are aspects that I will leave aside to others to  
7 talk about specifically, because I am not a PRA  
8 expert, per se.

9 But to attempt to answer your question the  
10 regimes that we have looked at, yes, they were not  
11 specifically to the power uprated regimes. But we do  
12 expect the licensees, when they do these power  
13 uprates, to take a look at the extended flow regimes  
14 and see if their applicables, or their usage of the  
15 VIP reports are going to be maintained so that they  
16 will stay applicable.

17 CHAIRMAN WALLIS: Are you speaking about  
18 vessel internals here?

19 MR. CARPENTER: Yes.

20 CHAIRMAN WALLIS: And isn't the flow rate  
21 the same though with the uprate as it was before? The  
22 places where you worry about increased flow are places  
23 like the dryers and separators, and places where the  
24 flow really has increased.

25 MR. CARPENTER: Right, which is outside

1 the safety components that we are looking at. So the  
2 basic internal components themselves as I had just  
3 mentioned, they pretty much --

4 CHAIRMAN WALLIS: I thought my colleague's  
5 question was why do you assume that what you did in  
6 the past is applicable to the future, might be  
7 answered by saying that there is no change in core  
8 flow, and so what happens inside the vessel is more or  
9 less the same as what happened before.

10 DR. FORD: Thank you for being my straight  
11 man. I guess I was questioning -- well, there are two  
12 things that are changing in the power uprate  
13 conditions. The flow rates and/or the flux.

14 CHAIRMAN WALLIS: That's why distribution  
15 is changing isn't it?

16 DR. FORD: Well, the flow rates, and/or  
17 flux patterns, oth in concert or separately, and in  
18 effect the cracking susceptibility.

19 The flux to a certain extent is taking  
20 current or in some of the later VIP documents, but not  
21 the flow rate. And so really my question is, is there  
22 anything that makes you feel good or bad about  
23 accepting these VIP documents which don't relate to  
24 the higher flow rates to this particular condition?

25 I have an opinion, but since I have a

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1 conflict of interest, I can't express it, and so I  
2 guess I --

3 CHAIRMAN WALLIS: Well, the question  
4 really isn't what makes him feel good or bad, but what  
5 would make us feel better.

6 DR. FORD: Am I allowed to express my  
7 personal opinion?

8 MR. BOEHNERT: I think you probably ought  
9 to refrain from that.

10 DR. POWERS: I agree. You are entirely  
11 welcome to ask questions, and if it leads us to an  
12 equivalent opinion, then that's fine. But I don't  
13 think you should guide us very much.

14 DR. FORD: Okay. I am now hamstrung.

15 MR. CARPENTER: To rephrase your question  
16 then --

17 DR. FORD: There are two things that have  
18 changed in Duane Arnold as they go into the power  
19 uprate; flux patterns, and/or flow rate. Both can  
20 individually and/or in conjunction affect cracking  
21 susceptibilities for most of the reactor components.

22 The VIP documents upon which yesterday and  
23 today we are seeing are saying that we don't have a  
24 problem with regard to stress corrosion and cracking.

25 Those VIP documents did not take into

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1 account changes in flow rate, per se. In fact, most  
2 of the data upon which those documents were obtained,  
3 the disposition curves, are extremely low flow rates.

4 And they don't take into account to any  
5 great degree changes in flux on the cracking  
6 susceptibility. So what makes you feel comfortable  
7 about accepting their requests for this reactor, which  
8 is operating in different conditions and which are  
9 pertinent to the VIP documents?

10 MR. CARPENTER: Well, I don't think I said  
11 that there is no problem here. If I did, I mis-spoke.  
12 What the BWR VIP documents give us is some assurance  
13 that there will be adequate inspections to determine  
14 if there is cracking before it will progress to a  
15 point that will be of concern to the staff, and  
16 obviously to the licensee.

17 The BWR VIP documents that have been  
18 reviewed and approved by the staff do specify a flux  
19 regime, that being less than 8 to the 21 fluence  
20 levels. Anything above that is considered a high  
21 fluence regime and we don't necessarily agree with the  
22 VIP at that point.

23 We are still in negotiations with with  
24 regard to BWR VIP regarding what if anything -- what  
25 additional inspections, if anything, should be

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1 performed by the licensees.

2 As far as the flow rates, as Dr. Wallis  
3 said, and as we agreed earlier, we will be coming back  
4 tomorrow or at a later point to talk further about  
5 that from a mechanical flow induced vibration point of  
6 view. Does that answer your question?

7 DR. FORD: The applicant took benefit if  
8 you like from the fact that they are using Noble Chem.  
9 How does that come into your evaluation?

10 MR. CARPENTER: Noble Chem the staff  
11 considers to be, when used adequately, a definite  
12 benefit to the water chemistries. Obviously, it adds  
13 in the hydrogen and to make use of it, and that  
14 reduces the crack growth rate by a significant amount.

15 Basically, we have given an order of  
16 magnitude reduction in crack growth rates for plants  
17 making use of that. So that is overall a very good  
18 thing from our point of view.

19 DR. FORD: Okay.

20 MR. CARPENTER: Any other questions?  
21 Well, specifically related to the internals.

22 CHAIRMAN WALLIS: Well, I am a little  
23 concerned that may be left with an uneasy feeling, and  
24 I am not quite sure how it is going to go away.

25 MR. CARPENTER: Which uneasy feeling is

1       that, sir?

2               CHAIRMAN WALLIS:   Just the whole way in  
3       which there have been responses to questions in the  
4       last hour or so.

5               DR. POWERS:   Well, specifically with  
6       respect to the inspection frequency, do we have any  
7       problems with that?

8               CHAIRMAN WALLIS:   Well, it is an  
9       extrapolation of past experience isn't it?

10              DR. POWERS:   I am sitting here wondering  
11      how can I design an inspection frequency that is not  
12      an extrapolation of past experience?

13              CHAIRMAN WALLIS:   Well, when you are  
14      uncertain and you presume, then you inspect more.

15              DR. FORD:   Am I allowed to give an  
16      opinion? Having put this bomb on the table --

17              CHAIRMAN WALLIS:   Well, you can ask  
18      questions and hoping that your opinion will appear  
19      from someone else.

20              DR. POWERS:   Okay. On this note, I am  
21      wondering if it wouldn't be appropriate at this point  
22      to take a break for about -- until 10:30.

23              CHAIRMAN WALLIS:   Okay.

24              DR. POWERS:   We will resume at 10:30

25              (Whereupon, at 10:17 a.m. the meeting was

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1 recessed and resumed at 10:33 a.m.)

2 DR. POWERS: Back on the record. I think  
3 we have progressed somewhat out of order. Can we get  
4 back into the order?

5 MS. MOZAFARI: What we want to do is just  
6 finish up on the material degradation issues, and I  
7 want to briefly give Gene here one more shot at  
8 addressing your questions, and then we have some  
9 discussion on stress corrosion cracking or flow  
10 cracking, the chemistry area for Kris Parczewski, who  
11 is going to provide that information. So why don't  
12 you go ahead.

13 MR. CARPENTER: And again the question as  
14 we left before the break was what precisely is the  
15 staff's level of comfort regarding the BWR-VIP  
16 documents and why it bounds the extended power uprate  
17 that Duane Arnold is asking for.

18 And again basically we have reviewed these  
19 documents to a great deal of level, and Duane Arnold  
20 is not looking at an increased, or an appreciable  
21 increase in flow in the area of concern.

22 So the crack growth rates in those areas  
23 should not significantly increase. It should not  
24 increase at all, especially that they are using Noble  
25 Chem.

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1                   So the staff has a great deal of comfort  
2                   in this area. Does that more adequately address the  
3                   question that you had?

4                   CHAIRMAN WALLIS: Yes, it does.

5                   MR. CARPENTER: Any other questions? If  
6                   not, thank you.

7                   MS. MOZAFARI: Okay. Chris, if you want  
8                   to go ahead and come on up.

9                   MR. PARCZEWSKI: My name is Kris  
10                  Parczewski, and I am from the Materials and Chemical  
11                  Engineering Branch, and I was involved in evaluating  
12                  the degradation of materials due to erosion/corrosion.

13                  As you can see on this slide, there are  
14                  several parameters which are or which would affect  
15                  erosion/corrosion, or accelerated corrosion as it is  
16                  now called.

17                  Two of them, velocity, which is at the  
18                  bottom here, which affects turbulence, and  
19                  temperature, are going to be affected by power  
20                  uprates.

21                  The licensee evaluated this change, and  
22                  came to the conclusion in general that the effect is  
23                  very, very minimal. The highest effect would be on  
24                  the feed line, and on the main steam line, and those  
25                  changes are going to be taken care of by modifying the

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1 core input in the code, so that it would predict the  
2 rate at which erosion/corrosion takes place.

3 And the staff was satisfied that this will  
4 probably take care of any effect of power outage.

5 CHAIRMAN WALLIS: And by the code do you  
6 mean the CHECWORKS code?

7 MR. PARCZEWSKI: This is the CHECWORKS  
8 code developed by EPRI.

9 CHAIRMAN WALLIS: I thought there was a  
10 very good presentation made yesterday on the fact that  
11 they do a lot of examinations by their  
12 erosion/corrosion program, and compared it against the  
13 CHECWORKS predictions. Did you see those  
14 correlations?

15 MR. PARCZEWSKI: The comparison?

16 CHAIRMAN WALLIS: Yes.

17 MR. PARCZEWSKI: I looked at them briefly.

18 CHAIRMAN WALLIS: But you saw them?

19 MR. PARCZEWSKI: Yes.

20 CHAIRMAN WALLIS: And can you -- and it  
21 was also mentioned that other plants have higher flow  
22 rates than that which Duane Arnold are applying to go  
23 through.

24 MR. PARCZEWSKI: Yes.

25 CHAIRMAN WALLIS: Have you seen data from

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1 other plants which reassures that extrapolating the  
2 CHECWORKS code is valid?

3 MR. PARCZEWSKI: No, I did not see that  
4 data. However, CHECWORKS was verified against several  
5 data, and so I trust the code would probably give you  
6 a proper prediction.

7 CHAIRMAN WALLIS: I don't doubt that, but  
8 I think we all have a problem that when you are  
9 starting to change -- and especially two variables,  
10 temperature and fluoride, and you are going to  
11 extrapolate them beyond your database, are you going  
12 to necessarily going to have a good correlation?

13 MR. PARCZEWSKI: You see, the CHECWORKS  
14 code was based on the data from several plants coming  
15 from this country and from abroad. So it has a very  
16 broad database it is based on, and it is being  
17 continuously updated. There is a special effort in  
18 EPRI which updates the data very often.

19 DR. FORD: But why a database that is  
20 being used to qualify the code includes conditions of  
21 temperature and flow rate that we are talking about  
22 here?

23 MR. PARCZEWSKI: Yes, that's right. It is  
24 bounded.

25 CHAIRMAN WALLIS: How much scatter is

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1       there in the data? I mean, do you see a correlation  
2       through this data?

3                   MR. PARCZEWSKI: Excuse me?

4                   CHAIRMAN WALLIS: Is there a lot of  
5       scatter in the data around this correlation?

6                   MR. PARCZEWSKI: There is quite a lot of  
7       scatter, yes.

8                   CHAIRMAN WALLIS: Typically how much?

9                   MR. PARCZEWSKI: I cannot tell you the  
10      exact number, you know, but there is not one single  
11      curve.

12                  CHAIRMAN WALLIS: So you used some average  
13      curve or upper bound, or what did you use?

14                  MR. PARCZEWSKI: Usually there is a bound,  
15      upper and lower bound, and obviously it has to be  
16      within those bounds.

17                  CHAIRMAN WALLIS: Do you mean the mean  
18      curve as a predictive tool?

19                  MR. PARCZEWSKI: I'm sorry?

20                  CHAIRMAN WALLIS: I am trying to figure  
21      out how you use -- you said that the data had to be  
22      between the bounds, and I didn't understand that. I  
23      mean, if you have bounds on the correlation, and when  
24      you take it to the other point, it has to be within  
25      the bounds?

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1 MR. PARCZEWSKI: Well, it has to be below  
2 the upper bounds.

3 CHAIRMAN WALLIS: And so what do you use  
4 for licensing purposes? Do you use the upper bounds,  
5 or the mean, or what?

6 MR. PARCZEWSKI: Well, upper bound  
7 obviously. It has to be the upper bound.

8 CHAIRMAN WALLIS: But does CHECWORKS  
9 predict the upper bound?

10 MR. PARCZEWSKI: I beg your pardon?

11 CHAIRMAN WALLIS: Does CHECWORKS predict  
12 the upper bound or just the mean?

13 MR. PARCZEWSKI: The means.

14 CHAIRMAN WALLIS: So how do you figure the  
15 upper bound into some licensing criteria?

16 MR. PARCZEWSKI: Well, it is -- I think  
17 the code is based on the data, and usually it is --  
18 definitely it predicts below or above the lower bound,  
19 and obviously to be on the safe side.

20 DR. FORD: Assume that the CHECWORKS  
21 prediction code looks like this, and you are saying  
22 that you have data that is in the upper bounds of the  
23 data, and the CHECKBOOKS, and that is the two  
24 questions that we have been asking. Here is Duane  
25 Arnold now, and --

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1 CHAIRMAN WALLIS: This is a freshmen  
2 course in data correlation and interpretation.

3 DR. FORD: And here is Duane Arnold's  
4 power uprate. Our questions have been is the Duane  
5 Arnold power uprate -- are there other data points  
6 which codify the CHECWORKS code, and the answer has  
7 been yes.

8 The next question was when Duane Arnold  
9 goes to this flow rate, what are they going to base  
10 their -- what do you approve their basis for their  
11 inspection in their erosion/corrosion program? Is it  
12 based on this value or this value?

13 MR. PARCZEWSKI: Well, you see, the data -  
14 - one thing is that the code is being calibrated each  
15 time, and so all the data from measurement are being  
16 included in the code. So it averages all the data  
17 which are being used for the calibration of the code.

18 DR. FORD: So it is not an absolute line.

19 CHAIRMAN WALLIS: That doesn't answer the  
20 question.

21 DR. FORD: The CHECWORKS is not an  
22 absolute correlation, which I thought it was.

23 MR. PARCZEWSKI: No, it has to be  
24 calibrated. Usually, you know, you take at least two  
25 measurements, two sets of measurements, and you add up

1 to the code to calibrate so to speak.

2 And each time you take the measurement,  
3 and you keep adding to the code, and so the code keeps  
4 getting more and more precise for a given plant as you  
5 yield more and more data.

6 CHAIRMAN WALLIS: Or it might be less  
7 precise if the data doesn't fit any pattern.

8 MR. SEVERSON: My name is Russ Severson  
9 with Duane Arnold, NMC. Let me try and add a couple  
10 of things here to try and help clarify a little bit.  
11 I think we are getting mixed up between flow rate and  
12 what has happened, and what the actual corrosion that  
13 has happened.

14 When you do apply CHECWORKS, and you do a  
15 corrosion program, you have two things going on at  
16 once. One is the model itself, and which is the EPRI  
17 model, and we have industry and international testing  
18 that went into the model at different parameters.

19 And you have your actual inspection data,  
20 and what CHECWORKS does is that it allows you to  
21 compare the two to see if your inspection data is  
22 matching your model, and therefore you have a clear  
23 understanding of what has previously happened to your  
24 system, and what will happen.

25 Now, what will happen with what we have

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1 performed here, and which Kris was trying to allude  
2 to, we did a parametric study using the CHECWORKS  
3 model to say, okay, we now believe we have modeled  
4 these lines fairly well because we have good  
5 predictions, and so therefore the code is working.

6 Now, within the code there is bounds of  
7 with these temperature changes, and the flow rates  
8 that we are seeing. So therefore with the code we can  
9 predict what will happen in these lines.

10 And since we prior could predict with this  
11 code, then we have very high confidence that we can  
12 predict in the future. Now, the temperature change  
13 really -- and as we showed you before, it is based on  
14 the solubility of the iron, and the temperature change  
15 really affects it, and you run the whole gambit of  
16 that line in feed water in these systems.

17 So all you really do is you change the  
18 location of where that happens, and so now we are  
19 having it happen a little bit forward in the feed  
20 water or in connate than we had before, would be your  
21 300 degree mark.

22 Whereas, the 300 degree mark would have  
23 been a different line prior to power uprate, and you  
24 see those effects.

25 CHAIRMAN WALLIS: The other question if

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1 you are going to use this figure on the board here is  
2 if you are doing inspections, and you are measuring  
3 corrosion rate, where did it actually fall in Duane  
4 Arnold, because this global correlation of data  
5 doesn't reflect the particular chemistry of a  
6 particular plant.

7 MR. SEVERSON: Well, I believe I  
8 understand your question. We don't -- go ahead.

9 CHAIRMAN WALLIS: If you put some  
10 measurements on that code for Duane Arnold  
11 measurements where would they be? I think we are  
12 saying that we can envision a logical process for  
13 decision making, but we don't quite understand what  
14 yours is.

15 We don't quite understand why the staff  
16 approved it, and that's all, and we can't follow the  
17 logic.

18 DR. POWERS: I think you have adequately  
19 expressed the challenge that we are facing here.  
20 Quite frankly, it looks to me like in many of our  
21 cases there is an approved methodology that the staff  
22 has accepted in the past.

23 And the question we are asking is how much  
24 investigation does the staff do for the application of  
25 this methodology for this particular application, and

1       how did they do it? And we are having challenges  
2       understanding that.

3               MS. MOZAFARI: So we will just take that  
4       under advisement. We will try to provide a basis.

5               CHAIRMAN WALLIS: I think it is more of a  
6       generic problem.

7               MS. MOZAFARI: Right.

8               DR. POWERS: It is very much a generic  
9       problem.

10              MS. MOZAFARI: Okay.

11              CHAIRMAN WALLIS: This is a generic  
12       problem.

13              DR. FORD: We are all scientists and we  
14       are interested in the details.

15              MS. MOZAFARI: Right.

16              DR. FORD: And therefore we are asking you  
17       how did you go through the analysis of these? I don't  
18       doubt that it is a good process. We are just  
19       interested in how did you do it and we are not  
20       understanding.

21              MR. PARCZEWSKI: Basically, we just  
22       verified the information provided to us, and our  
23       knowledge of the code, and that is probably a  
24       satisfactory way to predict the rate at which  
25       corrosion takes place.

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1 MR. SEVERSON: Kris, I have one more  
2 thing. This is Russ Severson again. I guess the  
3 point that I was trying to make was that I believe  
4 that we have validated and we have verified CHECWORKS  
5 works.

6 We know how to employ it at Duane Arnold,  
7 and we have inspections for it, and we know how to use  
8 the model to predict these new flow rates. And the  
9 fact that oxygen is just as important as flow.

10 There are many factors here that are just  
11 as important, and this is just one of them, and I  
12 believe that at Duane Arnold that we know what  
13 CHECWORKS is predicting, and we know what our wear  
14 rates are. And we have benchmarked the code.

15 MR. PARCZEWSKI: Basically the problem is  
16 that it doesn't involve only using predictive code,  
17 but relies on the actual measurement which is being  
18 done on the component that is most susceptible to  
19 erosion/corrosion. So there is outward verification.

20 DR. KRESS: How do you use this CHECWORKS  
21 prediction and in combination with the inspection  
22 findings to either say your inspection interval is  
23 okay, or to adjust it?

24 Are there criteria used to change your  
25 inspection interval or keep it? How is your

1 inspection interval decided in the first place?

2 MR. SEVERSON: The inspection interval is  
3 every outage. We can't get at these pipes without  
4 being in an outage because it is hot.

5 DR. KRESS: That's a pretty good criteria.

6 MR. SEVERSON: So what we do after an  
7 outage, and after our inspections, we pull these  
8 inspections, and we run the CHECWORKS code, and we  
9 predict what the wear rates will be by the next  
10 outage.

11 We decide where we want to inspect to  
12 further refine the model, and to further refine and  
13 show that our model is accurate, and what inspections  
14 we want to do for other reasons, and those are what we  
15 inspect, and we do that every outage.

16 DR. KRESS: And the CHECWORKS helps guide  
17 where to focus your inspections?

18 MR. SEVERSON: Well, yes. It gives us the  
19 feeling of what the wear is in the lines so that we  
20 can take whatever action that we need to do, that we  
21 believe that we need to do at that time.

22 CHAIRMAN WALLIS: And the measurements  
23 that you make when you do these inspections, do they  
24 agree with what you expected from CHECWORKS?

25 MR. SEVERSON: Yes, within what the model

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1 bounds are.

2 CHAIRMAN WALLIS: But that is not my  
3 question. We don't know how uncertain the model is.  
4 If we are going to go with something like the picture  
5 on the board, I would like to see some red dots or  
6 something which says this is where we actually are  
7 when we do our inspections, and this verifies that we  
8 are close to some mean line or upper bound, or  
9 whatever it is.

10 MR. SEVERSON: Well, I tried to push the  
11 important parts here. First, as I was saying before,  
12 in or flow water we have 130 or 140 mils of margin.  
13 I am attempting to closely lock in wear rates of  
14 between 3 and 4 mils per year. I believe that we have  
15 an excellent program to know when we are going to have  
16 problems.

17 CHAIRMAN WALLIS: Well, this is the  
18 problem that we have with lots of SERs, and we have an  
19 issue raised, and they say read the text, and it says  
20 we talked with the applicant, and the applicant  
21 assured us that CHECWORKS was used in some way, and  
22 this is a standard method.

23 And then it says that the staff finds the  
24 response acceptable. We get this all the time, and  
25 then when we start digging into it, we get into this

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1 kind of a situation, and we have got to do something  
2 about that.

3 There has got to be a better rationale for  
4 the acceptability I think that the staff presents to  
5 us. I mean, we can pick on any one of these, and if  
6 we just pick on a few and we get this kind of  
7 vagueness, then it doesn't reassure us too much.

8 DR. POWERS: I want to move on to another  
9 issue at this point. I think we have explored this  
10 one to the limit of our time availability now. I  
11 propose that we go to the PRA analyses and then the  
12 open issues.

13 MS. MOZAFARI: There is just one thing  
14 that I would like to say, and I probably should have  
15 said it up front. The staff's review approach -- and  
16 I think this is what you are trying to get at -- was  
17 how did they approach the reviews.

18 They pretty much looked at the ELTR-1 and  
19 2, and tried to give it the framework of what has been  
20 accepted in the past, and was it founded in some way  
21 by what is generically out there.

22 They looked at the Monticello safety  
23 evaluation, and that provided an indication of how  
24 deep to go into the review, and were there significant  
25 differences at Duane Arnold than there were at

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1 Monticello.

2 And then if there were plant specific  
3 design differences -- and this addresses most all of  
4 the systems -- they tried to address it in the safety  
5 evaluation. If there were not plant specific  
6 differences, if there was not something very unusual  
7 about the way Duane Arnold was addressed, then it may  
8 not have been brought out as something very specific  
9 and different.

10 So it would have followed the general  
11 approach at ELTR-1 and 2. And then the staff made  
12 several additional requests for information to  
13 corroborate what was in the supplement and what was in  
14 the original submittal.

15 And when we needed more information or we  
16 needed to be sure, you know, from our point of view to  
17 develop confidence in the staff, it is all documented.

18 DR. POWERS: The problem is that they are  
19 not documented. That when we look at the SER we get  
20 these vague assurances that the problem was resolved,  
21 and we don't understand why.

22 When we discuss it with you, it is not  
23 evident that you even understand the methodology, let  
24 alone how it was resolved. I would like to move on.

25 MS. MOZAFARI: Okay.

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1 MR. HARRISON: My name is Donnie Harrison,  
2 and I am with the PRA Branch in NRR, and I am going to  
3 try not to repeat everything that was said yesterday  
4 by the licensee.

5 I don't think you are going to see a whole  
6 lot of information that is different from my  
7 presentation than what Brad Hopkins gave yesterday.  
8 The Duane Arnold submittal, as Brenda just indicated,  
9 followed the ELTR-1, and they provided risk  
10 information per that.

11 The staff reviewed internal events,  
12 external events, shutdown operations, and the PRA  
13 quality. Under internal events, I just broke out that  
14 there is four main areas that we look at; initiating  
15 event frequencies, component reliability, success  
16 criteria; and operator actions.

17 Again, most of those topics were covered  
18 yesterday, and so I am just going to provide what the  
19 summary results are, and if you want to go into more  
20 detail, we can.

21 CHAIRMAN WALLIS: How do you assess PRA  
22 quality?

23 MR. HARRISON: It becomes a number of  
24 different factors that are involved. Basically, you  
25 are asking a question of does the plant models used in

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1 the PRA represent the plant that is operating, and in  
2 this case the plant that is going to be operating at  
3 extended power uprate.

4 And so I want to caveat that first with  
5 how that information is being used. In this  
6 application, it is only being used to confirm that  
7 there is no new vulnerabilities being created, or we  
8 are not on a cliff edge with our risk, and with this  
9 uprate, we will fall off the cliff.

10 It is more of a confirmatory analysis, and  
11 it is not done as a licensing analysis. With that in  
12 mind, we looked to see if there has been a peer  
13 certification done. We will look and see if there  
14 were any findings in the IPE and the IPEEE on the  
15 application's PRA in the past.

16 We will ask questions if we see that there  
17 is areas that are changing in the plant to see how  
18 those are modeled in the revised PRA, and so we will  
19 just confirm that the model does represent the as  
20 built or is going to be operated plant.

21 So you stole my thunder from my last  
22 slide. The first three topics under internal events,  
23 initiating event frequencies. The licensee indicated  
24 that they did not anticipate any changes in  
25 frequencies of events.

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1 I will note that there are changes  
2 occurring, and modifications occurring to main  
3 transformers, and the key electrical breakers, to make  
4 sure that there are operational margin.

5 The staff considers that as long as the  
6 equipment is operating within its margin, and within  
7 its operating limits, that we don't expect the  
8 frequencies to change.

9 DR. POWERS: What is the frequency  
10 dominant accident during normal operation?

11 MR. HARRISON: I believe it is the loss of  
12 all site power event, and ATWS -- and I confirmed that  
13 before here, and ATWS is second on that list, I  
14 believe.

15 DR. POWERS: Can the staff ensure that the  
16 increase in power is not going to affect grid  
17 stability?

18 MR. HARRISON: The grid stability question  
19 is typically answered through the electrical branch.

20 DR. POWERS: But they surely must have  
21 something packed in the PRA?

22 MR. TREHAN: This is Nedra Trehan,  
23 Electrical Engineering Branch. We do look at  
24 stability, not in detail, but that stability should  
25 be maintained -- with the largest unit on the grid, of

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1 the nuclear power plant unit, or the most critical  
2 transmission line.

3 And we see that those frequencies are  
4 within acceptable limits, and we do look at stability,  
5 the general capability curves, whether they are within  
6 the range, or lighting power factor range that they  
7 are being operated. Thank you.

8 DR. POWERS: And once they have done that  
9 assessment, how do you translate that into a change or  
10 no change in the frequency of station blackout?

11 MR. HARRISON: Well, what we do is we look  
12 at that as being a no change then in the frequency of  
13 --

14 DR. POWERS: No matter what it comes --

15 MR. HARRISON: As long as it is acceptable  
16 and it is within its margin, and within its operating  
17 limits, we at this point assume that the frequency  
18 will not change.

19 However, there are tracking means, and if  
20 plant specific data starts to show an increase, then  
21 that would be reflected in future updates of the PRA  
22 model.

23 And that same logic applies to component  
24 reliability. We don't expect any changes in failure  
25 rates, and there are monitoring programs, and

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1 maintenance rules, and other types programs, that are  
2 used to either maintain or to track the failure rates.

3 And at this time we don't see a change  
4 there. If one were to start to change in the future,  
5 it would be reflected in a future update of the PRA.

6 MR. TREHAN: This is Nedra Trehan.  
7 Regarding your question about the frequency. What we  
8 are doing with the power uprate is increasing the  
9 kilowatts, which is calculated into your frequency.  
10 If you are increasing the power kilowatt, your  
11 frequency is in better shape.

12 On the other hand, because KVA or MVA of -  
13 - if you are increasing the megawatts at the expense  
14 of -- for that we have to change that station's given  
15 power reactor, or install capacitor banks to take care  
16 of the large shortage created by a power uprate.

17 MR. HARRISON: Okay. As well, on success  
18 criteria, we don't expect any change. The licensee  
19 reran their -- some map runs to confirm that their  
20 success criteria as to the power uprate level had not  
21 changed, and that was the results of that analysis.

22 The one area that we did see where there  
23 were impacts were in operator response times. As  
24 indicated yesterday, there were five operator actions  
25 that were identified as potentially having raw values



1 of greater than 1.06, which meant that they could have  
2 a 10 to the minus 6 impact on CDF if they were assumed  
3 to be filled.

4 And four of those dealt with ATWS and one  
5 of them dealt with a high pressure transient event.  
6 On the ATWS, we broke it down into those four events,  
7 and they are SLC initiation, and the second one is  
8 inhibiting ADS if you have high pressure injection  
9 available.

10 The third one is initiation of lowering  
11 the water level to control power; and the fourth one  
12 as indicated yesterday was a combination of initiating  
13 SLC level and lowering power level with turbine bypass  
14 valves available.

15 On the first one, there was a question on  
16 timing of the SLC initiation at four minutes, and at  
17 that, I will pass that on to Dick Eckenrode to just  
18 provide some information the human factors folks have.

19 MR. ECKENRODE: My name is Dick Eckenrode,  
20 and we looked into all five of these events as far as  
21 the timing was concerned, because in all cases that is  
22 the key thing, is the time available has been reduced.

23 And the only one that was significant was  
24 this one, and we compared all five of them to ANSI  
25 Standard 58-9, which is a rather conservative standard

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1 in operating timing.

2 The only one that came close was this.  
3 This one, the ANSI standard actually said that it  
4 would have taken about 9 minutes, and we should have  
5 9 minutes. So they were already less than that with  
6 a six.

7 And then it had gone to four, and we asked  
8 a lot of questions of Duane Arnold, and got a lot of  
9 good answers, one of which is that this particular  
10 event is one of the critical tasks in the operator  
11 requalification program.

12 And it is looked at in all of the  
13 stimulator and a lot of the simulator runs. The one  
14 that we had them go back and give us a count of the  
15 number of times that they have run this.

16 And since 1997 through the present, it has  
17 been run I think 58 times, with a 100 percent success  
18 rate. We felt that this was significant to say that  
19 they could do it in the time available.

20 One thing you have to understand is that  
21 the time was not the critical item here, but  
22 approaching the byte temperature is the critical  
23 parameter. So they weren't really recording times.

24 They were simply looking at the comparison  
25 of the temperatures, and when the temperature got

1 close to the byte line, they initiated SLC.

2 As far as the actual actions that have to  
3 be taken, it was estimated by the licensee that it  
4 really takes about 10 to 15 seconds to perform the  
5 task. So we felt that they were well within the  
6 capabilities.

7 MR. HARRISON: The net result of the  
8 impacts of the operator actions on the overall CDF and  
9 LERF for the internal events are shown here as  
10 increases of 10 to the minus 6 approximately; and just  
11 a little over 10 to the minus 7 for LERF.

12 DR. POWERS: These are reiterations of the  
13 staff's analyses and the products of an independent  
14 analysis?

15 MR. HARRISON: Right. We did not perform  
16 any analysis to confirm the numbers. I will note also  
17 on the upper actions that we did ask the license to go  
18 back and just look to see if there were a number of  
19 operator actions just below their criteria for  
20 screening, which they did.

21 And they came back and only had one event  
22 that was close, and even with it, it was the recovery  
23 of river water supply, I believe, and that only had an  
24 impact of -- if you assumed it filled, it was a seven.

25 And the licensee also went back and

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1 doubled all their HEP values for things that were  
2 screened out, and showed that the impact was just a  
3 little over 10 to the minus 6. Both of those were  
4 just used as kind of a sensitivity data to confirm  
5 that we weren't missing anything.

6 And on the external events, Duane Arnold  
7 has a seismic and fires were evaluated, and all other  
8 external events were screened out.

9 CHAIRMAN WALLIS: Can we go back to that?  
10 The doubling -- the use of doubling, is that something  
11 that was proposed by the licensee, or something that  
12 you proposed, or was it negotiated? Could it have  
13 been a factor of something else?

14 MR. HARRISON: To be honest, I can't  
15 remember if we asked them to double, or if they  
16 provided -- I think they provided the doubling in  
17 response to a question that we asked them about the  
18 sensitivity of the results to things that had been  
19 screened out. I think that is what happened.

20 And the staff accepted that just as a  
21 sensitivity, and not as -- again, as a confirmation  
22 that there was not a lot of actions that can pile up  
23 together to get you there.

24 On external events, like I said, other  
25 than seismic and fires, other external events were

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1 screened out through the EPRI process. There is no  
2 direct impacts of the power uprate on earthquakes and  
3 fires.

4 And their analysis just shows a path  
5 through the upper actions that were shown to be  
6 important, and the internal events pass through these  
7 external events as well.

8 They did not identify any vulnerabilities  
9 that were created by the power uprate, and when you  
10 increase the external events CDF by that, you get an  
11 increase of 2 to the minus 8, for an overall external  
12 event probability of 3.7 to the minus 6.

13 And I believe that is all fire if I am  
14 correct, because they do a seismic margins analysis.  
15 So on the seismic area, it is just to ensure that  
16 there is no vulnerabilities created as part of the  
17 uprate.

18 DR. POWERS: Power ampere and more current  
19 flow, does it change the risk of a switch gear fire?

20 MR. HARRISON: That would be a component  
21 failure question again, and I think you would be  
22 dealing with what is the probability of having an  
23 event like that.

24 And I don't think you would be able to get  
25 a good number one way or the other on what that would

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1 be as a result. I think conceptually that you are  
2 right. You could increase the fire.

3 DR. POWERS: I honestly don't know. I  
4 mean, all I know is that we have the IPEEE insights  
5 report that tells us which --

6 MR. HARRISON: And I do know that they did  
7 a fire analysis at Duane Arnold. I don't recall what  
8 was the actual dominant failure modes that resulted in  
9 the six value. I am not sure.

10 And if we move into shutdown operations,  
11 I think as was indicated yesterday, there is an  
12 increased decay heat during shutdown operations, and  
13 so that is going to extend the time where you have two  
14 pumps that have to be available, RHR decay heat  
15 removal.

16 You are going to have reduced times to  
17 boiling, and therefore you are going to have shorter  
18 operator response times. However, for BWRs, typically  
19 those times are in the matter of hours, and so you  
20 typically won't impact your operator action human  
21 error probabilities.

22 As well, Duane Arnold uses a shutdown risk  
23 management process, NEMARC 91-06, and they monitor a  
24 number of different capabilities and features through  
25 that through an outage.

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1           The staff looked at that and determined  
2           that based on having a risk management approach, and  
3           based on the fact that you have hours to boiling  
4           typically, that that was an acceptable risk management  
5           approach and would be acceptable for a power uprate.

6           DR. POWERS: Yesterday in our discussion  
7           of the analysis of human error probabilities,  
8           primarily connected with normal operations, and not  
9           the shutdown operations, the speaker acknowledged that  
10          he did not have expertise in that area, but said that  
11          they had looked at those probabilities in a variety of  
12          ways, and he thought that included fires.

13          Did you look specifically at how they  
14          calculated the human error probabilities?

15          MR. HARRISON: No, we did not. If you  
16          will note, the human error probabilities that they  
17          were using -- for example, the four minute time window  
18          for ATWS and SLC initiation, in my view was a  
19          conservative number.

20          It is almost 20 percent of the time that  
21          they are saying that their operators are going to  
22          fail. They have got data that supports that they make  
23          it all the time. So in looking at that, I see their  
24          analysis as being conservative, and their numbers tend  
25          to be that way.

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1           Their human error probabilities that we  
2 did look at, you weren't down in the 10 to the minus  
3 4 for operator actions in 15 minutes. You were  
4 looking at high 10 to the minus 2s. And those seem  
5 reasonable.

6           So we didn't look at specific methods, but  
7 we looked at the reasonableness of the numbers that  
8 they were producing. And just to touch on PRA  
9 quality. Again, the question is how it is being used  
10 in this decision making process, and the risk  
11 information is being used to provide confirmatory  
12 information, and it is not being used to make the  
13 ultimate decision.

14           It is just a support tool. The staff  
15 looked at the IPE and the IPEEE and safety evaluations  
16 that were performed, and they did not identify any  
17 major weaknesses in the Duane Arnold IPEs.

18           Duane Arnold uses their PRA as part of  
19 assessing hardware changes. So it is used as part of  
20 the plant configuration operating process. And then  
21 the final thing that we also considered was the fact  
22 that it was through a BWR Owners' Group peer  
23 certification process 3 or 4 years ago or so.

24           And those factors we considered in  
25 determining that we thought that the Duane Arnold PRA

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1 was acceptable for its use in this application.

2 And the last slide just provides a summary that walks  
3 through each of those areas that we have just  
4 discussed, and presents just a little bit of results.

5 Their change in CDF and change in LERF  
6 values are in the small risk increase area for  
7 internal events. They are in the very small risk  
8 increase range for external events. Again, noting  
9 that is fires.

10 And they have got a process for shutdown  
11 operations and the staff found their PRA acceptable  
12 for this application.

13 DR. POWERS: I have to say that I am much  
14 happier with the statement under shutdown operations  
15 that there is negligible risk, rather than what you  
16 said on the first or the original slide, which says no  
17 significant impact. There certainly is an impact.

18 MR. HARRISON: Right.

19 DR. POWERS: There may be no increase in  
20 risk.

21 MR. HARRISON: Right. There is an  
22 operational impact.

23 DR. POWERS: But there is a very definite  
24 impact.

25 MR. HARRISON: That's true. I will change

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1 my slide for next time. And that is the presentation  
2 of the PRA. I would be glad to answer any questions.

3 DR. POWERS: I would ask this question,  
4 and you may not be the right one to answer, but I'm  
5 just curious. As soon as this power uprate gets  
6 implemented the IPE for Duane Arnold is no longer  
7 germane by in large. Does the staff then go about  
8 changing the work sheets that the inspectors have for  
9 the significance determination process?

10 MR. HARRISON: That is a question that I  
11 hadn't even thought of. Do we have any thoughts?

12 DR. POWERS: You may not be the one to ask  
13 that question.

14 MR. RUBIN: This Mark Rubin from the  
15 staff. I can't give you a good answer as to the SDP  
16 work sheets, but for the maintenance rule  
17 implementation, certainly their assessment of  
18 maintenance impacts for assessing the programs have to  
19 rely on a PRA that is adequate to the task.

20 And during a maintenance rule follow-up  
21 inspection, if they were not reflecting that, I think  
22 they would not be in compliance with the rule  
23 requirements.

24 DR. POWERS: One other question that comes  
25 to mind in that vain is if you look at changes in the

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1 CDF and changes on LERF, did you look at changes in  
2 raw and risk reduction worth of components and  
3 systems?

4 MR. HARRISON: Not directly, but just as  
5 a note, that when the licensee performed their screen  
6 of what components to look at, they used a raw value  
7 for components and operator actions. So there is some  
8 consideration of that in the process, but it is not  
9 like you did a raw for including initiating events and  
10 everything else.

11 DR. POWERS: Any other questions of the  
12 PRA work that was done, recognizing again that this is  
13 supportive and not the basis of the application? If  
14 not, I think we can move on to the next subject.

15 MS. MOZAFARI: You did ask some questions  
16 about -- you did want us to address grid stability,  
17 and we do have some members from the electrical branch  
18 here if you have some specific questions concerning  
19 grid stability.

20 DR. POWERS: I thought we had gotten the  
21 answer earlier.

22 MS. MOZAFARI: You are happy with that

23 DR. POWERS: Well, I got the answer.

24 MS. MOZAFARI: The answer may not have  
25 been sufficient for what you wanted, but --

1 DR. POWERS: Well, I understand what you  
2 did.

3 MS. MOZAFARI: Okay. Then we will just  
4 move on. There were open issues that were indicated  
5 in the draft safety evaluation. One of them had to do  
6 with the start up testing, and the start up testing  
7 issue, Mohammed Shuaibi has been following it pretty  
8 closely.

9 The staff has not come to closure on that  
10 yet, but it doesn't -- it is not an issue at Duane  
11 Arnold at this point, and it will be handled in a  
12 license condition when they get to the point where  
13 they would trigger the requirement to do start up  
14 testing.

15 And by that time we would have made a  
16 decision on the start up testing with our staff. It  
17 doesn't become an issue for Duane Arnold at this  
18 point. So this will remain an issue that will be  
19 addressed when Duane Arnold gets to the power level  
20 start up testing where needed.

21 And then the other issue had to do with  
22 MPSH, and Kerry Kavanaugh is going to -- we have a one  
23 page handout for that to pass around.

24 MS. KAVANAUGH: I am Kerry Kavanaugh of  
25 the staff. As you heard yesterday, it is the

1 licensee's position that their licensing basis for the  
2 use of containment overpressure is based on margin,  
3 which is 2.7 psig.

4 And they also stated that when they were  
5 originally licensed that they were licensed with  
6 credit for containment overpressure. The staff agrees  
7 that they were licensed for use of containment  
8 overpressure from their original licensing basis.

9 However, the staff does not agree that  
10 their licensing basis is based on margin. The staff  
11 believes that their licensing basis is based on the  
12 magnitude of the overpressure required and the  
13 duration of that overpressure as it is required.

14 This was reflected in their original  
15 response to the staff questions on their MPSH when  
16 they were licensed. It was in -- their response was  
17 a graph that presented the containment pressure versus  
18 the time, which represented where the pressure was in  
19 the containment over the accident analysis, along with  
20 the MPSH requirements during that same time period.

21 This graph was in the Duane Arnold FSAR  
22 and updated FSAR, up until 2000 when it was changed,  
23 the figure was changed. During the years, we believe  
24 that that graph was the basis for their licensing  
25 basis.

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1                   When we got to this issue, we had quite a  
2                   few discussions on it. The staff has reviewed in some  
3                   respects their MPSH calculations, and we agree with  
4                   their MPSH analysis for the extended power uprate.

5                   We have sent them a letter, dated  
6                   September 25th, that basically tells them that any  
7                   change that increases the magnitude or the duration of  
8                   the required overpressure than what they are using for  
9                   their extended power uprate would trigger 10 CFR 50.59  
10                  criteria, and would require staff review and approval.  
11                  That will close the open issue.

12                  DR. POWERS: I guess I understand the  
13                  approach. Are you telling me that this is an issue  
14                  that will be resolved if I just wait long enough?

15                  MS. KAVANAUGH: Well, unfortunately, we  
16                  couldn't resolve it. So they removed that figure from  
17                  the graph that we were using as their licensing basis.  
18                  It is now a containment pressure versus suppression  
19                  pool temperature, which shows that as the pool  
20                  temperature goes up that they will require containment  
21                  overpressure.

22                  It doesn't tell you how long they are  
23                  going to need it, nor does it tell you how much per  
24                  se, because you really don't know how long they are  
25                  going to be there.

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1                   When we discussed containment  
2 overpressures issues with the ACRS staff 3 or 4 years  
3 ago, we gave you our approach to resolving the  
4 increasing number of licensees that were coming in  
5 needing it, and it was based on this time and  
6 duration, and an understanding of how much they  
7 needed.

8                   And we have not had problems with Duane  
9 Arnold in the past because we had this information on  
10 the docket. We don't have that now.

11                  CHAIRMAN WALLIS: What is the criteria for  
12 acceptability for this time and duration? They  
13 mentioned 2.7 psi required, and they showed us that  
14 they had much more than that. They didn't say much  
15 about time.

16                  MS. KAVANAUGH: They didn't say anything  
17 about time.

18                  CHAIRMAN WALLIS: Is time the problem  
19 then?

20                  MS. KAVANAUGH: It is very plant specific  
21 as to what the criteria is. We have a safety guide,  
22 Safety Guide 1, that says that you should not be  
23 granting any containment overpressure for your break  
24 LOCA analysis.

25                  However, there is a handful of plants with

1 specifically boilers that cannot meet this  
2 requirement, and they were licensed not meeting the  
3 safety guide originally and we were aware of this.

4 As time has gone on, there has been  
5 changes with the plants, and most specifically with  
6 the BWRs with the strainer issue, and all the BWRs  
7 have replaced their ECCS strainers.

8 And that has changed their headlocks  
9 calculations, which is has changed their reliance on  
10 containment overpressure, along with other  
11 modifications to the plant.

12 When plants come in needing credit for  
13 overpressure, the approach that we have used is that  
14 we give them what they need, because we haven't found  
15 any licensees willing to change their pumps out of  
16 their plants.

17 So our only opportunity is to evaluate  
18 their license, approve their analysis, but give them  
19 what they need and allow some room such that they can  
20 have some flexibility for operational changes.

21 Some plants need higher amounts of  
22 overpressure and some don't. For Duane Arnold,  
23 because they are going up to 209 degrees, I believe is  
24 your peak pool temperature, they are going to need  
25 approximately 5.8 psig, and I don't remember for what

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1 the time period was, versus two before the EPU.

2 If you look at another plant with higher  
3 pump requirements, they would be needing a higher  
4 amount for a lot longer amount of time.

5 CHAIRMAN WALLIS: Well, I don't quite  
6 understand your philosophy of giving them what they  
7 need. How is this related to public safety?

8 MS. KAVANAUGH: Well, since we know what  
9 their analysis is, and we are looking at the risk  
10 associated and the frequency of having a large break  
11 LOCA, we know what their analysis is.

12 And the analysis for the containment  
13 analysis is generally very conservative. They use the  
14 super HEX code. They use the ANS 5.1 decay heat,  
15 along with a two sigma margin.

16 Their analysis is done for worst case. So  
17 it is generally a very conservative analysis. There  
18 really isn't any other way to -- besides changing out  
19 the pumps, which would be very expensive for them, to  
20 have them meet this safety guide. I mean, the --

21 CHAIRMAN WALLIS: Well, should I feel good  
22 about that? It looks as if you -- that when they need  
23 something, you give it to them, but I don't understand  
24 the criteria for ever turning them down.

25 MS. KAVANAUGH: Well, I don't believe

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1 there has been a criteria for turning them down.

2 CHAIRMAN WALLIS: Well, you might as well  
3 just say we have got a rubber stamp here.

4 MS. KAVANAUGH: What we do is with a lot  
5 of care and consideration. I understand your concern,  
6 and it has been a hard spot for all of us, but --

7 CHAIRMAN WALLIS: Is this another case  
8 where the rationale is fuzzy?

9 MR. SHUAIBI: This is Mohammed Shuaibi  
10 again. We do go back and look at what is available.  
11 It's not that we will give them whatever they want.  
12 We will go back and look at what is available and make  
13 sure that it is available.

14 We will look at their containment pressure  
15 calculations as we did in this case. So there is  
16 margin there. It is not that we will give them what  
17 they want, and given a situation where their pumps  
18 aren't going to be able to perform.

19 MS. KAVANAUGH: I mean, the key assumption  
20 is that the containment pressure will be there as long  
21 as you don't lose that containment pressure. The  
22 concern is if that containment pressure isn't there.

23 CHAIRMAN WALLIS: Well, isn't there then  
24 perhaps a power uprate level where you would stop  
25 giving them what they need? If they wanted a 25

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1 percent power uprate, and then this would give you a  
2 suppression pool temperature of 215 or something -- I  
3 mean, there must be some point where you say you can't  
4 have what you need.

5 MS. KAVANAUGH: Well, we haven't reached  
6 that evidently yet.

7 CHAIRMAN WALLIS: Apparently not. How do  
8 you know when you reach it?

9 DR. KRESS: And where do you decide it  
10 will be?

11 MS. KAVANAUGH: No, there is no definition  
12 as to where it would be.

13 CHAIRMAN WALLIS: So there is no speed  
14 limit?

15 MS. KAVANAUGH: But our only control is  
16 reviewing the analysis and then getting staff  
17 approval. That is our only mechanism for control.

18 MS. MOZAFARI: Mohammed, do you want to  
19 address that?

20 MR. SHUAIBI: I think clearly that there  
21 is a speed limit. I think what your containment is  
22 able to withstand is a speed limit, although that is  
23 the extreme.

24 CHAIRMAN WALLIS: There is no speed limit  
25 for MPSH per se then?

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1 MR. RUBIN: This is Mark Rubin again, and  
2 I will just jump in because I think Mr. Hannon has  
3 already left this meeting. Clearly, I would only  
4 point out that the safety guide is a not a regulatory  
5 requirement.

6 It is a review guideline, and a very old  
7 one additionally. I think perhaps what we are being  
8 told is that the staff's evaluation of the plant  
9 specific containment analysis is showing that the  
10 actual pressure that a good analysis shows is well in  
11 excess of the extra delta-P that they need for the  
12 MPSH requirements.

13 And the staff has confidence that the ECCS  
14 systems will successfully operate because of that  
15 analytical result, and that public safety is ensured  
16 because of that.

17 DR. POWERS: How does that square with the  
18 single failure requirements for the pumps.

19 MS. KAVANAUGH: I'm sorry?

20 DR. POWERS: How does that square with the  
21 single failure criteria for the pumps?

22 MS. KAVANAUGH: Well, most plants are not  
23 licensed to assume a failure of containment along with  
24 a LOCA. I mean, that is beyond their design basis.

25 MR. RUBIN: If you mean a single failure,

1 or a single active component failure that would result  
2 in increased head requirements, I'm sure that is in  
3 the analysis.

4 MS. KAVANAUGH: Oh, yes, that is in the  
5 analysis.

6 DR. POWERS: All right. But your answer  
7 is the one that I was looking for.

8 MS. KAVANAUGH: Okay.

9 DR. POWERS: She got it right. She knew  
10 what I was talking about, even if I didn't.

11 CHAIRMAN WALLIS: I guess I would be more  
12 reassured if instead of what I heard was give them  
13 what they need, if there were some kind of an  
14 explanation like it affords here where you have got  
15 some kind of prediction that they are making, and this  
16 is what they need.

17 And then you can explain why it is  
18 acceptable to be in the region in which they propose  
19 to be based on some argument which is quantitative and  
20 logical.

21 MS. KAVANAUGH: Well, I mean, I understand  
22 your concern that they do do a containment analysis.  
23 It is a minimum containment analysis.

24 And they use that as a basis to show now  
25 much containment pressure they have available. They

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1 don't use all that containment pressure.

2 CHAIRMAN WALLIS: Well, they believe that  
3 the pumps will operate?

4 MS. KAVANAUGH: They believe that the  
5 pumps will operate.

6 CHAIRMAN WALLIS: And what is your basis  
7 for believing the pumps will operate?

8 MR. SHUAIBI: I think in this case -- and  
9 this is Mohammed Shuaibi again -- that we did  
10 confirmatory analysis in this case --

11 MS. KAVANAUGH: For the containment.

12 MR. SHUAIBI: -- confirmatory containment  
13 analysis for this case, and we are comfortable with  
14 their values on the pressure that is involved in  
15 containment for the scenarios. Unfortunately, we  
16 don't have the lead reviewer for that here, and that  
17 is what we offered earlier, that he could comment to  
18 the full committee and talk about those independent  
19 analyses that we did.

20 DR. POWERS: From a historical point of  
21 view, let me see if my understanding -- and you can  
22 feel free to correct me if my historical perception in  
23 this area is inaccurate.

24 When we originally licensed these plants,  
25 credit was given for overpressure for MPSH because of

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1 the physical fact that it was running and intact, and  
2 the coolant loses its density because of its elevated  
3 temperature if there was going to be containment  
4 overpressure.

5 That in recent years, we became less  
6 confident in that as a safety margin, and we  
7 questioned whether that overpressure was appropriate  
8 to grant overpressure.

9 And there are some plants that are  
10 licensed to use the containment overpressure. That is  
11 an irreversibly fact of life, but we are nervous when  
12 we grant these things.

13 MS. KAVANAUGH: We are getting nervous  
14 because they are requiring more. If you look at the  
15 original analyses, it was a pound here, and less than  
16 a pound. Now we are getting into time periods where  
17 they are needing 5 or 6 pounds for several hours.

18 MS. KAVANAUGH: So, yes, that is where the  
19 level of uncomfortable comes from.

20 DR. SCHROCK: What is the basis of the  
21 confirmatory containment analysis? What method is  
22 used?

23 MS. KAVANAUGH: I did not do that  
24 analysis. That is something that we can discuss  
25 tomorrow, but I believe they used the contain program.

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1 DR. SCHROCK: I am not going to be here  
2 tomorrow.

3 CHAIRMAN WALLIS: There is no tomorrow.

4 MS. KAVANAUGH: Oh, okay.

5 MR. SHUAIBI: Again, the lead reviewer on  
6 this is not here, but we can discuss that at the full  
7 committee meeting. We offered to do that.

8 DR. SCHROCK: I won't be there either.

9 MS. KAVANAUGH: But I believe they used  
10 the contain program as -- do you remember? You're no  
11 help -- the confirmatory analysis code.

12 MR. BROWNING: This is Tony Browning from  
13 Duane Arnold again. The staff was using the contain  
14 code, and requested a great deal of data from us so he  
15 could benchmark his model to our containment design  
16 and specific parameters so that he could do the  
17 confirmatory analysis. So that is how it was  
18 performed.

19 DR. POWERS: Any other questions?

20 CHAIRMAN WALLIS: Well, if these plants  
21 don't meet the guidelines, maybe what you need is a  
22 new set of guidelines which logically explain a change  
23 in position, and explain the rationale for giving  
24 credit for these overpressures.

25 MS. KAVANAUGH: That is a good point.

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1 CHAIRMAN WALLIS: And then set some limits  
2 to what is acceptable based on some criterion, which  
3 might even be related to risk or something that we can  
4 grasp a hold of.

5 Would it be unreasonable that you  
6 recommend that you rewrite the guideline to be more  
7 specific, and explicit, and rational?

8 MS. KAVANAUGH: I believe at one point  
9 -- and I don't remember specifically, but I believe it  
10 is Reg Guide 182, that also deals with MPSH analysis.

11 And there was an effort at one time to  
12 combine the safety guide in with that, because that  
13 deals with vortexing and all kinds of fun stuff, and  
14 into one reg guide which would explain that. But I  
15 don't know where the staff's effort is on that  
16 initiative or not.

17 MR. BOEHNERT: How many plants are  
18 affected by this?

19 MS. KAVANAUGH: I would say we have 2 or  
20 3 PWRs, which are multiple unit sites; and I would say  
21 about 12 BWR sites. You will find that the newer  
22 units don't run into this problem. Their MPSH  
23 requirements on their pumps are extremely low.

24 DR. POWERS: Thank you.

25 MS. MOZAFARI: By way of concluding, I

1 just wanted to reiterate a little bit that the staff  
2 used the ELTR-1 and 2 as the framework for the review.  
3 It was more or less the outline that they followed to  
4 see that everything got addressed.

5 They used the Monticello safety evaluation  
6 more or less as a template to kind of scope the depth  
7 of the reviews. Plant specific design differences  
8 were addressed, and that's why you ended up with a  
9 foot of documents.

10 Usually it was the back and forth of  
11 questions that the staff asked Duane Arnold  
12 specifically about their design and submittals. And  
13 then these were followed up by follow-ups from  
14 telephone conferences that supported the staff  
15 reviews, and documented by the information requests.

16 This pretty much lays out the scope of the  
17 review, and it is consistent with the ELTR-1 and 2,  
18 and the way it was provided, and it pretty much does  
19 address all areas.

20 Further guidance on review is provided by  
21 the SRPs in the different systems areas. And they did  
22 follow their SRPs. And this states what the staff has  
23 concluded in the draft safety evaluation, and will be  
24 seen again in the safety evaluation, that all areas  
25 affected by the extended power uprate have been

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1 reviewed and evaluated.

2 And all the methodologies used for  
3 extended power uprate analyses are acceptable to this  
4 staff for this application; and the results of the  
5 analyses were acceptable, and there were cases as we  
6 have indicated where we did confirmatory analysis.

7 The PRA results showed an acceptably small  
8 increase in risk associated with the extended power  
9 uprate, and therefore the proposed extended power  
10 uprate of 15.3 above CRTP, which is 20 percent above  
11 the original license power level is accepted for Duane  
12 Arnold. Are there any other questions?

13 DR. POWERS: Well, thank you. What I  
14 would like now is to move to a discussion with the  
15 committee to discuss what we want to present --

16 MR. SHUAIBI: Dr. Powers, Mohammed Shuaibi  
17 again. There were a couple of questions that came up  
18 earlier, I believe, that you wanted to talk about,  
19 namely grid stability and something with containment  
20 hydrogen and questions that came up about that. We  
21 have people here to address those questions if you  
22 want.

23 DR. POWERS: I think we got the answer on  
24 the grid stability.

25 CHAIRMAN WALLIS: And that the oxygen

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1 didn't meet the requirements, but somehow or other  
2 that was acceptable for some reason. Was that the one  
3 that you were mentioning; the 5 percent oxygen  
4 requirement.

5 We were told that they didn't meet the  
6 requirements at the start of the event, but for some  
7 reason this was judged to be okay because it was not  
8 a time where you really needed to worry about the  
9 issue or something.

10 It was a reassurance that the staff has  
11 good rationale for allowing the licensee not to meet  
12 requirements. That's all.

13 MR. PERALTA: This is Jim Peralta from the  
14 Plant Systems Branch. There is a period of  
15 approximately 24 hours where after the LOCA where the  
16 hydrogen monitors would not operate as accurately as  
17 they are supposed to.

18 The licensee has stated that they in fact  
19 will be indicating somewhat high, which would be a  
20 conservative direction, and it is essentially on that  
21 basis that we accepted it.

22 CHAIRMAN WALLIS: So it would seem that  
23 they would meet the requirements if they overestimate  
24 something and then they are conservative, and then  
25 they are essentially meeting the requirements; is that

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1 correct?

2 MR. PERALTA: Yes.

3 CHAIRMAN WALLIS: Were there requirements  
4 written in some way that doesn't reflect this ability  
5 to be conservative?

6 MR. PERALTA: The point was that the  
7 instrument wouldn't be working as it was originally  
8 intended to work because it would be outside of its  
9 design parameters. However, it would be indicating in  
10 a conservative direction, yes.

11 DR. POWERS: And were certain that nothing  
12 irreversible happens to this device?

13 MR. PERALTA: Well, I don't know that we  
14 asked them that specifically, but that certainly is  
15 implicit in -- well, they said after that period of  
16 time that it would begin operating within its design  
17 parameters. That it would go back to operating within  
18 its design parameters.

19 CHAIRMAN WALLIS: To monitoring hydrogen?

20 MR. PERALTA: Yes.

21 CHAIRMAN WALLIS: And there was a five  
22 percent oxygen requirement that you are trying to  
23 verify, or is that something else?

24 MR. PERALTA: As far as I know, it is the  
25 hydrogen monitoring. I didn't see anything on oxygen.

1 CHAIRMAN WALLIS: That they monitored  
2 oxygen, and that they reached the 02 limit one day  
3 earlier without the power uprate. Maybe this also  
4 needs come clarification. Perhaps again we could have  
5 something written to the subcommittee so we can look  
6 at it before we have to go before the full committee.

7 MR. BROWNING: Excuse me, Dr. Wallis.  
8 This is Tony Browning from Duane Arnold again. These  
9 are combined monitors. They monitor both oxygen and  
10 the hydrogen content in the containment. So you are  
11 monitoring both.

12 CHAIRMAN WALLIS: They are conservative  
13 about oxygen or hydrogen, or both?

14 MR. HUEBSCH: This is Steve Huebsch from  
15 Duane Arnold. They are conservative when the  
16 containment temperatures are higher than the heat  
17 trace temperature, and the analyzers are conservative  
18 for both.

19 The issue that comes up then is the fact  
20 that if they aren't within their accuracy bounds for  
21 the Reg Guide 197 criteria, the operators could  
22 perform an action prior to needed.

23 That was part of the discussion early on.  
24 So if they were reading your five percent oxygen level  
25 at a point where --

1 DR. KRESS: It is really 3 percent.

2 MR. HUEBSCH: Yes, and if it is only 3  
3 percent, the operators might be in a situation where  
4 they would attempt to perform compensatory actions to  
5 deal with high levels of oxygen/hydrogen.

6 So one of the things that we have  
7 identified is that when you get into the EOPs and  
8 start looking at the event that you are talking about  
9 2-1/2 days, or 2.3 days by the analysis, before you  
10 would ever get to the situation, and that is via a  
11 conservative calculation.

12 What we can do with the analyzers is even  
13 though the temperatures caused this over prediction in  
14 the analyzers, or a slight over- prediction when they  
15 get down close to the heat trace temperatures, they  
16 still do trend.

17 So the operators can watch a trend in  
18 increasing levels over time for the first 24 hours,  
19 and they will be able to tell where their  
20 hydrogen/oxygen levels are leading.

21 We have also got calculations that we have  
22 had in the past that compensate for those. We don't  
23 have those calculations currently in our operating  
24 instructions because when we installed the heat trace,  
25 we took those out.

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1           The one thing that we are looking at now  
2           is we are saying that we have the ability to trend the  
3           hydrogen/oxygen levels. They will be a little over-  
4           predictive until the containment temperatures drop  
5           within the band of the heat trace.

6           And the calculations show that that will  
7           occur within the first 24 hours, and the conditions  
8           won't affect the analyzers adversely.

9           So once the 24 hours period comes down the  
10          operator can look over, and in essence what we have  
11          done in the EOPs is that he can look at the  
12          temperatures in the containment, and make the  
13          assessment of the accuracy of the --

14          CHAIRMAN WALLIS: But the argument is no  
15          longer that they are conservative because they are  
16          reading high. It's whether or not they mislead the  
17          operators because they are reading too high, and then  
18          you are going to have to have proper operator training  
19          to not be mislead by this reading, which is due to the  
20          fact that you put a heat source close to the sensors.

21          MR. HUEBSCH: They have already had the  
22          training as part of the operation.

23          CHAIRMAN WALLIS: So this is acceptable  
24          because the staff accepts that the operators will  
25          still take the right actions because they will know to

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1 not misunderstand these faulty readings. Is that the  
2 way the staff resolves it? That wasn't the  
3 explanation that we got first.

4 DR. KRESS: Well, if the operators take  
5 the action that was intended at the wrong time, it  
6 still would be an effective action, and the safety  
7 issue is a question of if you guys don't want to mess  
8 up your operations by having them do it when they  
9 didn't have to. Wouldn't that be a better way to  
10 characterize it?

11 MR. HUEBSCH: Yes. Their compensation  
12 would be to inject --

13 DR. KRESS: So if they did make an error,  
14 it's not a fatal error.

15 MR. HUEBSCH: No. You would inject the  
16 CAD, and you would add a nitrogen mask to the  
17 containment, and still stay within the pressure limits  
18 because the system was designed that way. You would  
19 mitigate it with a change of time sequence for events.

20 DR. KRESS: Yes.

21 CHAIRMAN WALLIS: Well, maybe what is  
22 indicated here is that this was a draft SER, and when  
23 you write about oxygen and hydrogen that it will be  
24 clarified in the final SER.

25 Now, what is the procedure then? Do we

1 actually have to look at the final SER?

2 MS. MOZAFARI: We are in the process of  
3 getting the final SER done, and you would see the  
4 final SER, but I believe that what we are looking for  
5 is that any questions that you refer to us, we will  
6 evaluate those in concert with the final SER.

7 CHAIRMAN WALLIS: I am wondering if we  
8 should have a full committee meeting before we have  
9 this final SER? We have had this debate before, where  
10 there was something about the SER that we were unhappy  
11 about, and then something got approved, and before we  
12 got to approve something that was in draft form, with  
13 the assurance that something would be fixed. I wonder  
14 if that is the appropriate way for us to act.

15 MS. MOZAFARI: Well, we would expect to  
16 get your comments, but I think that some of the issues  
17 that you were commenting on we were planning to  
18 present at the full committee anyway, and we would  
19 incorporate any suggestions into the final safety  
20 evaluation, and so they would be addressed.

21 DR. POWERS: Well, how much time has the  
22 committee allocated for this?

23 MR. BOEHNERT: We have -- let's see, about  
24 an hour-and-a-half, from 8:35 to 10:15 on October 4th.

25 MR. SHUAIBI: I guess that question is to

1 the ACRS, but what I would offer is if we can provide  
2 you written responses to those questions that you  
3 have, and provide you an explanation of our review  
4 process at the full committee. We would rather do it  
5 that way, but obviously it is up to you.

6 DR. POWERS: I would like to talk to the  
7 members now about what they would like to see the  
8 staff and the licensee present, and I would begin with  
9 the licensee.

10 My personal bias is that we ask the  
11 licensee to give a fairly summary discussion of what  
12 he has done to change his plant and then to present  
13 his PRA results, perhaps with even a little more  
14 detail on the work that he has done on human  
15 reliability, and also some human error analysis,  
16 because I think my rationale for doing that is that  
17 that gives him this summary opportunity to speak to  
18 the committee, in terms of the language which it  
19 likes, which is risk.

20 I think he has done some things that I  
21 think are innovative there. At the same time, he  
22 needs to give a summary of the things that he needs to  
23 change in his plant, which look to me to be fairly  
24 minimal.

25 DR. KRESS: I agree with what you say,

1 Dana, with one exception. I think the power uprate is  
2 being reviewed on the basis of compliance with the  
3 regulations.

4 DR. POWERS: It is.

5 DR. KRESS: I think the committee would  
6 want to and would need to hear how they -- the story  
7 about how they are complying with the various limits  
8 that they have to meet for the power uprate. So I  
9 would have what you said, but I would want to see a  
10 summary version of the compliance also.

11 CHAIRMAN WALLIS: We need to hear more  
12 about ATWS don't we in the full committee? That seems  
13 to be one of the compliance areas.

14 DR. POWERS: Well, my thinking with regard  
15 to the ATWS -- or at least what I was thinking of --  
16 well, Tom is right. This is a compliance application  
17 and what not.

18 Quite frankly, the licensee is electing to  
19 deal with ATWS in a way that we have already seen. He  
20 is not introducing a great deal of innovation. He is  
21 following a plan that has been developed by GE, and if  
22 memory serves, we discussed at length.

23 There are some subtleties to it that I  
24 don't really fully understand that we could go into,  
25 but I thought it would be better to go into those

1 compliance issues with the staff.

2 I think we have to make a decision on what  
3 we would do here, because given the amount of time --

4 DR. KRESS: We don't have a lot of time,  
5 that's for sure.

6 DR. POWERS: And what I don't want to do  
7 is get the licensee and the applicant into a position  
8 of having to give such a summary presentation that all  
9 he does is everybody sits around and -- that the full  
10 committee just gets confused, because they haven't all  
11 seen this.

12 DR. KRESS: I think the plant changes and  
13 the PRA summary both go pretty fast.

14 DR. POWERS: I think we need to decide  
15 -- well, the way they handled the PRA in the  
16 presentation to the subcommittee was a fairly lengthy  
17 package, but a short terse presentation as befits its  
18 role.

19 If we wanted to keep it that way, then I  
20 think it is no more than a view graph showing the  
21 bottom line results, and not any greater discussion on  
22 that.

23 DR. KRESS: I think the view graphs that  
24 show what led to the bottom line results have a few of  
25 them, but mostly human error is based on the human

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1 error changes, and is based on the timing. I think  
2 those would also be appropriate to have in there,  
3 because that is the whole basis for the changes.

4 And this discussion on the use of  
5 compliance for the events, I think that belongs or  
6 could be part of it.

7 DR. POWERS: So what you are basically  
8 saying is that you would like to see a summary of  
9 everything that was presented?

10 DR. KRESS: Well, no. They went through  
11 a great deal of trouble to answer all the ACRS  
12 questions that we put to them ahead of time. I don't  
13 really think we need to go through those again.

14 I think they just give the slides to them  
15 or something, and let the rest of the committee read  
16 them. But I don't see how we can avoid going through  
17 the compliance part of it.

18 DR. POWERS: I wasn't going to avoid that.  
19 I was going to go through that with the staff.

20 DR. KRESS: Oh. Well, that may be, but I  
21 don't know if the full committee will be pleased with  
22 just saying that they did all the calculations using  
23 approved codes and met the limits.

24 DR. POWERS: Well, I think we have to give  
25 them something fairly specific. I don't think we can

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1 say give us a summary and then come back and say,  
2 well, that wasn't enough detail. That just is not  
3 playing fair.

4 So let's talk through the topics that were  
5 presented and say do we want to hear about that or  
6 not.

7 DR. KRESS: Okay.

8 DR. POWERS: Okay. They have compliance  
9 with regulatory requirements, and they have hardware  
10 modifications, analyses performed, and impact on plant  
11 margins.

12 DR. KRESS: I think I want to hear those  
13 and the whole basis of that.

14 CHAIRMAN WALLIS: That is the whole basis  
15 for the decision.

16 DR. POWERS: If they are going to go  
17 through it, then we are going to hear it again from  
18 the staff. That's the thing that I was trying to  
19 avoid.

20 CHAIRMAN WALLIS: Well, they went through  
21 that fairly briefly.

22 DR. POWERS: All right. We have plant  
23 operator training, stability monitor/instability  
24 avoidance.

25 DR. KRESS: I think I can do without both

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1 those.

2 CHAIRMAN WALLIS: What we really need to  
3 do is the stability if you want to show anything at  
4 all. There is orange curves and that you can actually  
5 get up past them, and things --

6 DR. KRESS: Yes.

7 DR. POWERS: Okay. So we want to go  
8 through that. ATWS event response for uprate  
9 conditions.

10 CHAIRMAN WALLIS: I am tempted to ask the  
11 staff why they accepted the ATWS response, but that  
12 may take a long time.

13 DR. POWERS: You are going to get that  
14 opportunity.

15 CHAIRMAN WALLIS: We don't need to go  
16 through all the details of that.

17 DR. POWERS: Well, I think it is do they  
18 go into it or not. There is nothing detailed in the  
19 45 minutes that I am going to give them. I mean, we  
20 have got an hour-and-a-half.

21 CHAIRMAN WALLIS: Well, I think we have to  
22 have something about ATWS, because ATWS is going to  
23 turn out to be the power influences to the PRA later  
24 on isn't it? So I think you have to say something to  
25 that before --

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1 DR. POWERS: Graham, I understand what the  
2 problem is, but they have got 45 minutes, and so that  
3 means they get 23 minutes to talk. That means that  
4 they get one view graph on each one of these topics,  
5 or we yell at the planning and procedures, because  
6 they have only give us an hour-and-a-half here.

7 DR. KRESS: I think that is where the  
8 problem is.

9 CHAIRMAN WALLIS: Well, I think you have  
10 to say that ATWS was handled in the standard way, and  
11 what has changed here is that the operators have to  
12 respond quicker. That's what they have to say. Can't  
13 they say that quickly?

14 DR. POWERS: No, because someone like you  
15 will ask them something that they don't feel obligated  
16 to answer.

17 CHAIRMAN WALLIS: It won't be me, but I  
18 know who it might be.

19 DR. POWERS: But there are committee  
20 members who have been known to ask questions at least  
21 as detailed as yours. Okay. Is there any topic on  
22 here that they don't need to go into?

23 DR. FORD: You could argue that materials  
24 degradation -- if you are talking about the time  
25 available, materials degradation issues, I have got my

1 own opinion as to how important they are or not.

2 And I have put myself in the position of  
3 your technically informed person out in the public,  
4 and how they would react to presentations given today,  
5 in terms of the amount of quantitative data from the  
6 assessment on material degradation issues. Dana, I  
7 don't know if those minutia should be covered in the  
8 full committee meeting. I would suspect not, but I  
9 would hate to see our recommendations not taken  
10 account of.

11 DR. POWERS: We will get to draft a letter  
12 and provide the committee with a summary. I can't  
13 imagine your esteemed colleague from Oregon sitting  
14 quietly and having been drugged through the details of  
15 ATWS response not getting at least a chance to hear  
16 the word CHECWORKS.

17 So if you are going to go into this  
18 detail, we are going to do it twice; once with the  
19 licensee and once with the staff, and we had better  
20 cover them all.

21 I would hope they would not have to go  
22 through the discussion with the dryers and the  
23 separators. They are not safety issues, and nothing  
24 emerged out of this that suggests that that would  
25 change. But that is the only one so far that I have

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1       been able to take off this list.

2                   I mean, what you are saying is that you  
3       would like to see a compact version of this, the  
4       presentation that they prepared for us yesterday  
5       afternoon.

6                   DR. FORD:   Apart from the dryers and  
7       separators, which I agree with you, the safety issue  
8       is the question of the quantitative treatment of the  
9       VIP vibration criteria for stress corrosion and  
10      cracking.

11                   The details of the FIV, which I personally  
12      don't believe is a big problem, but as presented,  
13      somebody could turn around and say it is not  
14      adequately supported in the information given. And  
15      the other one is the one that you brought up, the CUF  
16      factors, and why are some up and some down. What is  
17      the rationale.

18                   I personally don't think that these are  
19      big deals. But to someone outside this room, you  
20      don't see any evidence that they are a big deal. Do  
21      you understand my point? In what venue do you sort  
22      these things out and do you record preservation of  
23      those?

24                   DR. POWERS: Right now I am only trying to  
25      give guidance to the licensee on what he is going to

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1 have to present. We have given him no help whatsoever  
2 because all we have said is that we want to hear four  
3 hours of presentation in 23 minutes.

4 And I don't think he is going to dance at  
5 his daughter's wedding over this one.

6 DR. FORD: I am quite willing to put my  
7 hand up and say don't mention it given the time, and  
8 I don't think there is any need to have a big  
9 discussion on materials degradation.

10 But I would hate to see it in the public  
11 environment, where this is not enough sufficient  
12 quantity for discussion.

13 DR. POWERS: Well, there are multiple  
14 things that go out on a public venue, and the staff  
15 evaluation report is a public document, and does go  
16 into this subject.

17 DR. FORD: But is it worthwhile for me  
18 just to write down my comments here and give them to  
19 the staff? Is that good enough?

20 DR. POWERS: There is another public  
21 document, and that is the ACRS letter, and I am not  
22 sure who it goes to right now. There are multiple  
23 avenues for bringing this up.

24 It appears to me that the recommendation  
25 of this subcommittee to the licensee on what he

1 presents -- and understand that the licensee can use  
2 his own good judgment on what ought to be presented --  
3 is that you attempt to go through the Items 1, 2, 3,  
4 and 4 in the agenda, and 5.

5 And I would suggest that in light of the  
6 time limitations that you not go into the PRA results.  
7 It is not part of their application. It is going to  
8 provoke a lot of discussion, and you haven't got time  
9 available to you to cover it in a way that you will  
10 find satisfactory the items that are being presented  
11 to you.

12 And Dr. Ford has suggested that you can  
13 limit the amount of discussion that you do on the  
14 corrosion substantially. I think the committee has  
15 been through CHECWORKS as an entity in some detail in  
16 the past, and those that have an interest in it have  
17 all been through it fairly in detail.

18 I think if you want to approach the  
19 subject, it is adequate to say that you looked at flow  
20 erosion using the CHECWORKS methodology, and let it go  
21 at that.

22 Otherwise, it sounds like most of these  
23 things they want to address.

24 MR. MCGEE: Could I review the list once?

25 DR. POWERS: You certainly can.

1 MR. MCGEE: This is Ron McGee. So you are  
2 requesting that we would cover next week during the 23  
3 minutes allotted --

4 DR. POWERS: You will have 45 minutes and  
5 we usually count that in 45 minutes that we have had  
6 quite a cross-section of the committee here. So you  
7 might shade that a little bit, and take a little more  
8 time.

9 MR. MCGEE: Thank you. So, the plant  
10 modifications and then regulatory compliance, and the  
11 analysis performed, operator training, thermal-  
12 hydraulic stability, the ATWS response, fuel response  
13 for ATWS instability, and material degradation --

14 DR. POWERS: I think that you can handle  
15 that with one sentence there. If somebody else had a  
16 question, I think that can be pretty promptly handled  
17 because you are using fairly standard methodologies  
18 here, or that are familiar to the rest of the  
19 committee. There is nothing ground breaking in this.

20 MR. MCGEE: Okay. Our containment  
21 analysis.

22 CHAIRMAN WALLIS: I think you would have  
23 to show your justification for your MPSH. I think you  
24 have one summary curve that shows the containment  
25 pressure and the pressure required, et cetera. It has

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1       been an issue, and it is something that the staff has  
2       raised. So you have to make your case for that.

3               MR. MCGEE: We can skip the steam dryer  
4       and separators.

5               DR. POWERS: I think you can.

6               MR. MCGEE: ECCS analyses.

7               CHAIRMAN WALLIS: That's the bottom line.  
8       I think you need to have a bottom line; that of the  
9       1300 and something degrees. You need to reassure that  
10      you will meet the criteria.

11              DR. POWERS: Yes, and I would approach  
12      that with a little caution, and make it clear that you  
13      have two limits, and why you have two limits, and why  
14      you comply with both of them, just because that is  
15      new. And you can go on to say that the second one may  
16      actually evaporate one of these days or something.

17              CHAIRMAN WALLIS: Now, why is he skipping  
18      PRA?

19              DR. KRESS: Don't have the time.

20              CHAIRMAN WALLIS: I think he has to show  
21      the PRA bottom line. I think you have to show the  
22      bottom line on any issue that is significant.

23              DR. POWERS: Graham, I know something  
24      about some of the members of the committee, and if we  
25      ask them to show a bottom line on the PRA, those

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1 members of the committee will say a bottom line isn't  
2 good enough for me.

3 CHAIRMAN WALLIS: Then we are going to  
4 need to have more time. This is the place where the  
5 licensee makes the case in a public forum that an  
6 uprate should be granted, and it has got to be a fair,  
7 comprehensive case. It doesn't have to be detailed,  
8 but it has got to cover main arguments.

9 DR. POWERS: The PRA is not part of the  
10 case.

11 CHAIRMAN WALLIS: Well, it is a  
12 consideration, and I think the conclusions here are  
13 kind of similar.

14 DR. POWERS: I feel a responsibility to  
15 comply with what the planning and procedures have  
16 given me for time, and I am afraid that if just giving  
17 a bottom line on the PRA is --

18 CHAIRMAN WALLIS: It is going to be asked  
19 anyway. It's not going to be asked for anyway?

20 DR. POWERS: And that is the other thing.  
21 Remember, I came in here with a going in position of  
22 just doing the PRA.

23 CHAIRMAN WALLIS: And that's why I  
24 wondered why you flipped completely.

25 DR. POWERS: Because I can't ask them to



1 do everything in 23 minutes.

2 CHAIRMAN WALLIS: Then they need more  
3 time.

4 DR. POWERS: I could ask them to do  
5 everything if I gave them the whole morning. I would  
6 keep my PRA results in my pocket, and just hit them  
7 with the bottom line numbers on it. And if it is  
8 provocative, I will take the time out of Wallis' hide.

9 CHAIRMAN WALLIS: I have a topic that we  
10 can vote on in five minutes.

11 DR. POWERS: What did you say?

12 CHAIRMAN WALLIS: I am very happy to take  
13 some time out of my topic.

14 DR. POWERS: I think you have done -- I  
15 actually think you have done some innovative things  
16 with the PRA that would be of interest to the  
17 committee.

18 MR. MCGEE: The information that we  
19 provided yesterday, all the slides and stuff, will  
20 that be provided to the full committee prior to our  
21 meeting with them?

22 DR. POWERS: That would ordinarily not be  
23 the case. They could get it if they asked for it.  
24 But that would not ordinarily be the case that they  
25 would have it.

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1 DR. KRESS: Quite often we have had people  
2 come in with a package like that and say we are not  
3 going to present this, but if you would like to read  
4 these, here is a group of slides that tells you.

5 DR. POWERS: And as I said, I think you  
6 have done some innovative things with your PRA that I  
7 wouldn't be stunned if you advertised it. I think you  
8 have done an evaluation and in screening your human  
9 performance issues using PRAs to identify things.

10 And I think what you did for screening of  
11 components that is in your PRA was an innovative act  
12 in your application. I would have enjoyed exploring  
13 with you just to see how you did it and whether it was  
14 useful, and whether you would ever do it again.

15 But I think you have time to perhaps  
16 discuss that with individual members if they ask  
17 questions, and you may be able to present the bottom  
18 line numbers and what not.

19 The trouble is that this committee -- the  
20 full ACRS committee, their eyes tear over and they put  
21 hands on their heart when the word PRA comes up, and  
22 they have more questions than most people would ever  
23 be able to generate answers.

24 And here we are focusing more on power  
25 uprate issues, which of course you are doing

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1 innovative things there, too. Now, I would like to  
2 come to the staff presentation at this meeting.

3 And I will begin again with my suggestion  
4 to the committee, and see if they will overrule me,  
5 just as efficaciously as they did with respect to the  
6 applicant.

7 It seems to me that opposing sets of  
8 questions for the subcommittee meeting, in the  
9 interest of efficiency, we may have sandbagged the  
10 staff a little bit. And that we need to give them  
11 more freedom to design their presentation.

12 And I would encourage them to design their  
13 presentation to dissuade the committee from writing a  
14 letter that begins, "With the ACRS unable to ascertain  
15 if the staff has done an adequate review of the Duane  
16 Arnold application for a power uprate. Our  
17 examination of the SER suggests the staff has asked  
18 perceptive, probing questions. Documentation of the  
19 resolution of these questions in the SER is quite  
20 limited has become the familiar pattern for SERs."

21 "Our discussions with the staff did not  
22 produce satisfactory amplification of the SER. Too  
23 often the staff appears to have accepted a methodology  
24 that has been proven in the past without showing that  
25 it has also done an adequate investigation into the

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1 application of the approved methods."

2 "After oral discussion with the staff, it  
3 is not apparent that the staff is adequately familiar  
4 with either the methods or the specific application."

5 I think that I would like the staff to  
6 make a presentation that forecloses writing that kind  
7 of a letter.

8 CHAIRMAN WALLIS: In 45 minutes.

9 DR. POWERS: In 45 minutes.

10 CHAIRMAN WALLIS: With questions.

11 DR. POWERS: With questions. I think the  
12 areas that the subcommittee has pursued in here give  
13 you some guidance to what we are looking for when we  
14 say have you done an adequate application or  
15 investigation on how it was applied to the specific  
16 issue here.

17 I think we are in general familiar with  
18 those approaches that the staff has accepted in the  
19 past, and it is really how they were applied that is  
20 at issue here.

21 And as I said, when I read the SER, I  
22 found -- my general impression in reading the SER were  
23 the questions that the staff was asking were the right  
24 questions. In fact, they were very good.

25 It's that their final resolution doesn't

1       come through as clear and clarifying. I am giving you  
2       my personal viewpoint, and I will turn to the rest of  
3       the committee and see what they would like to hear  
4       from the staff.

5               DR. KRESS: Personally, I will bite off  
6       from what you said. That would have been my  
7       recommendation.

8               DR. POWERS: Professor Wallis, have you  
9       any guidance that would like to give the staff on  
10      their presentation?

11              CHAIRMAN WALLIS: Well, I think you have  
12      given them a challenge. I'm just wondering how they  
13      will respond to it. I guess I will just have to wait  
14      and see.

15              DR. POWERS: I remain confident that they  
16      can, because again I looked at the SER, and I looked  
17      at the kinds of questions that were being asked, and  
18      addressed, and I thought that they were perceptive and  
19      challenging questions.

20              CHAIRMAN WALLIS: The only thing that I  
21      worry about is the committee getting into some of the  
22      morass that we got into; is that when we start probing  
23      the rationale for the decisions, we have difficulty  
24      getting answers to the questions posed. I don't want  
25      that to happen with the full committee. The answer

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1 should be crisp and to the point and reassuring.

2 DR. POWERS: Professor Schrock, can you  
3 give us some help here?

4 DR. SCHROCK: Probably not. I have been  
5 concerned for a long time about this issue of the  
6 falling back on the fact that analyses are done in  
7 accordance with previous approvals, and frequently  
8 that gets in the way of communicating an understanding  
9 of what is done and how it is applied in the present  
10 situation. I think you have said that very well.

11 And I am glad to hear that challenge  
12 thrown up to the staff. I think that is something  
13 that needs to change and it needs very badly to  
14 change.

15 So apart from my strong feeling on that,  
16 I don't think I can give you a lot of guidance on how  
17 you are going to cope with your problem of getting all  
18 this information exchanged in this short period of  
19 time.

20 DR. POWERS: And Dr. Ford.

21 DR. FORD: I have four specific questions  
22 that you can pass on to the staff.

23 DR. POWERS: Oh.

24 DR. FORD: You are giving them a  
25 challenge, and I am giving them four specific

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1 questions to help them meet the challenge.

2 DR. POWERS: Very good. Do you want to  
3 share them with us?

4 DR. FORD: Well, we have already gone  
5 through it in the other meeting. It is the CDF  
6 situation and FIC, and FAC, and the corrosion/ erosion  
7 cracking. I can give them to you. I have gotten them  
8 written out.

9 DR. POWERS: Okay.

10 MR. SHUAIBI: Dr. Powers, can I ask a  
11 question?

12 DR. POWERS: Certainly.

13 MR. SHUAIBI: This is Mohammed Shuaibi of  
14 the staff again. Is it your perception that the  
15 entire safety evaluation is this way, or is it just  
16 inadequate in certain areas?

17 DR. POWERS: I did not in the course of  
18 the presentation find an area that we asked questions  
19 in that I thought was handled in a way that was  
20 reassuring. Well, I take that back. I found the  
21 answers to the NPSH margin questions by the section  
22 head were answered promptly and explicitly.

23 MS. KAVANAUGH: Thank you.

24 DR. POWERS: Now, the criterion question  
25 that Dr. Wallis asked still is more nebulous, but I

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1 don't know that you are responsible for that in this  
2 application. Okay. Any other comments that the  
3 members would like to make?

4 Have we given you -- I'm sure that we  
5 haven't given you enough, but would you like to hear  
6 me talk anymore?

7 MS. MOZAFARI: No, I think we have an  
8 idea. We will go back and revisit our conclusions,  
9 and our evaluations to make sure that we have been  
10 clear enough about the basis for the evaluations.

11 DR. POWERS: Feel free to interact with  
12 Mr. Boehnert, who will be in a position to pass on any  
13 clarifications that you might need.

14 MS. MOZAFARI: Okay.

15 DR. POWERS: With that, I will turn the  
16 meeting back to Professor Wallis.

17 CHAIRMAN WALLIS: I would like to thank  
18 the representatives from Duane Arnold and GE, and the  
19 staff, and my colleagues for their contributions to  
20 this meeting, and I will adjourn the meeting.

21 (Whereupon, the opening meeting was  
22 recessed at 12:20 p.m.)  
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: ACRS Thermal Hydraulic

Phenomena Subcommittee

Docket Number: (Not Applicable)

Location: Rockville, Maryland

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