

**NUCLEAR REGULATORY COMMISSION**

**ORIGINAL**

Title: Advisory Committee on Reactor Safeguards  
Thermal-Hydraulic Phenomena Subcommittee

PROCESS USING ADAMS  
TEMPLATE: ACRS/ACNW-005

Docket Number: (not applicable)

Location: Rockville, Maryland

Date: Thursday, October 25, 2001

Work Order No.: NRC-082

Pages 1-224

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

October 25, 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 (ACRS)

7 + + + + +

8 THURSDAY

9 OCTOBER 25, 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. WILLIAM SHACK, Member

23 DR. VIRGIL SCHROCK, ACRS Consultant

24 DR. JOHN D. SIEBER, Member

25

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ACRS STAFF PRESENT:

PAUL A. BOEHNERT, ACRS Staff Engineer

I-N-D-E-X

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

(1:00 p.m.)

CHAIRMAN WALLIS: The meeting will now please come to order. This is a meeting of the ACRS Subcommittee on Thermal-Hydraulic Phenomena. I am Graham Wallis, Chairman of the Subcommittee.

Other ACRS Members in attendance are Peter Ford, Thomas Kress, William Shack, and Jack Sieber. The ACRS Consultant in attendance is Virgil Schrock.

The purpose of this meeting is for the subcommittee to review the license amendment request of the Exelon Generating Company for core power uprates for the Dresden Nuclear Power Station, Units 2 and 3; and the Quad Cities Nuclear Power Station, Units 1 and 2.

The subcommittee will gather information, and analyze relevant issues and facts, and formulate the proposed positions and actions as appropriate for deliberation by the full committee. Mr. Paul Boehmert is the Cognizant ACRS Staff Engineer for this meeting.

The rules for participation in today's meeting have been announced as part of the notice of this meeting previously published in the Federal Register on October 15, 2001.

Portions of this meeting may be closed to

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1 the public as necessary to discuss information  
2 considered proprietary to General Electric Nuclear  
3 Energy.

4 A transcript of this meeting is being  
5 kept, and the open portions of this transcript will be  
6 made available as stated in the Federal Register  
7 notice. It is requested that speakers first identify  
8 themselves, and speak with sufficient clarity and  
9 volume so that they can be readily heard.

10 We have received no written comments or  
11 requests for time to make oral statements from members  
12 of the public. I will say what I said before the last  
13 meeting that we had on power uprates, that this  
14 committee has received a large stack of papers, which  
15 amounted to over two feet high.

16 Some of my colleagues said that was an  
17 underestimate last time. I am really looking forward  
18 to your help in pointing us to the elements of that  
19 which are important for us to consider. So I will  
20 now proceed with the meeting, and I will call upon Mr.  
21 Bill Bohlke of the Exelon Generating Company after my  
22 colleague, Peter Ford, makes a statement.

23 DR. FORD: Yes. I am a GE retiree, and  
24 therefore I have a conflict of interest.

25 MR. BOHLKE: Thank you. Good afternoon,

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1 Mr. Chairman, and Members of the ACRS. I am Bill  
2 Bohlke, senior vice president of nuclear services for  
3 the Exelon Corporation, and the executive sponsor for  
4 the extended power uprate project for Dresden and Quad  
5 Cities.

6 We have brought many members of our  
7 project team who have been working on this project for  
8 almost two years now, and that this team of engineers,  
9 and analysts, and operators, I think is pretty well  
10 positioned to answer the question that you may have  
11 from reading the material and anything that comes up  
12 from their presentation, which we hope will help  
13 clarify and distill all of the information that you  
14 have been asked to digest.

15 This is an important project for our  
16 company. As you are already aware, Dresden and Quad  
17 Cities are BWR-3s licensed for commercial operations  
18 from 1969 through 1972 or '73.

19 Recently, we have seen significant  
20 improvements in the reliability and safe operation of  
21 those plants, and in addition to this extended power  
22 uprate request, we are preparing a license renewal  
23 application for Dresden and Quad which will be  
24 submitted at the end of next year.

25 So we have got a substantial investment

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1 going forward in these plants, and we are anxious to  
2 tell you how we plan to integrate this uprate into our  
3 operations, and why we believe that this uprate can be  
4 safely and reliably achieved.

5 We are also aware that you just went  
6 through similar material about a month ago on the  
7 Duane Arnold project. There are many, many  
8 similarities between what you heard a month ago, and  
9 what you will hear today.

10 But there are also some differences,  
11 because these are BWR3s, and a little bit older than  
12 a Duane Arnold plant. Nevertheless, let me summarize  
13 as I conclude what I think you are going to hear.

14 That we have followed the GE designed  
15 approach for an extended power uprate described in  
16 their EPU license topical report for a constant  
17 pressure upgrade. That is to say, the steam dome  
18 pressure doesn't change.

19 You will see that we have provided an  
20 extensive sweep of analyses using methodology that has  
21 been reviewed by the staff and you many times before  
22 to analyze these plants, and in several cases these  
23 methodologies.

24 We represent an upgrade from the previous  
25 sweep of methodologies and analyses that existed for

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1 the units, and we have benefited from that, and we  
2 will also be able to demonstrate that the inputs to  
3 the analyses are accurate and reasonably conservative  
4 in addition.

5 The results of all of this work that we  
6 have gone through, and the modifications which are  
7 ensuing on Dresden 2 as we speak, because Dresden 2 is  
8 in the outage during which the modifications required  
9 for an extended power uprate must be implemented.

10 And you will see that at the end of the  
11 day there are in fact no significant impacts on the  
12 way that the plant responds to initiating events or  
13 the way that the plant operates during transients.

14 And there are no challenges to system  
15 integrity that are of any concern for us in an  
16 engineering context. Near the end of the  
17 presentation, you will hear a rather extensive review  
18 of the risk assessment of this uprate.

19 And I think when you have seen what we  
20 have done and have heard the results, you will  
21 conclude as we have that there are minimal changes in  
22 plant risk.

23 Thus, from all aspects, we believe that  
24 the plant operation following the increase in power to  
25 the extended level will be acceptable and safe. At

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1 this time, pending any questions, I would like to turn  
2 it over to our project manager for this project, Mr.  
3 John Nosko. Thank you.

4 MR. NOSKO: Good afternoon. My name is  
5 John Nosko, and I am the project manager for the  
6 Dresden and Quad Cities extended power uprate  
7 projects.

8 Our presentation this afternoon has been  
9 constructed to generally follow the guidelines of the  
10 agenda provided by the subcommittee. It incorporates  
11 materials to address the questions received from the  
12 ACRS before the meeting.

13 And we expect to take just over two hours,  
14 Mr. Chairman, to cover all of the topics, which allows  
15 time for questions from the subcommittee. We have  
16 with us today members of our project team from Exelon,  
17 and from General Electric, Stone & Webster, and Aaron  
18 Engineering here, to support the presentation.

19 There is no proprietary information  
20 contained in our presentation, but it may turn out  
21 that responses to some of your questions would bring  
22 out proprietary information. If that is the case, we  
23 will ask to address the matters separately with you,  
24 or in a closed session.

25 So looking at the agenda, we propose to

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1 cover our compliance with regulatory issues in the  
2 introduction and project overview. We will talk about  
3 selected analyses and evaluations as requested by the  
4 committee.

5 A separate presentation will focus on  
6 probabilistic risk analyses, and including a discussion  
7 on open items identified in the draft safety  
8 evaluation report.

9 And finally we will talk about  
10 implementing the power uprates at the station from the  
11 perspective of an operating license holder. Our  
12 submittal is requesting a 17 percent increase in  
13 license power level.

14 The goals of our project are to safely use  
15 the excess capacity currently available at the  
16 stations to increase power production levels to  
17 leverage industry experience using a proven and  
18 accepted methodology to minimize the impact of that  
19 uprate on the plant by maintaining a constant reactor  
20 dome pressure.

21 And to make our analyses and designs for  
22 both stations as similar as possible to simplify  
23 reviews and configuration management going forward.  
24 Our submittal was prepared in accordance with the  
25 license topical reports for extended power uprates.

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1 They are ELTRs 1 and 2.

2 And it demonstrates compliance with  
3 applicable regulations and safety limits. The  
4 analyses that we have done consider a variety of  
5 operating transients, postulated accidents, and  
6 operating conditions.

7 We have evaluated the radiological  
8 consequences and environmental impacts of the uprate,  
9 as well as the effect of the uprate on station  
10 programs.

11 Now, we have taken only one exception to  
12 the license topical reports, and that is for  
13 conducting major transient testing at uprated power  
14 levels.

15 Our presentation will address why we are  
16 taking that exception, and why we believe there is  
17 compelling data to support that position. The  
18 committee has also asked us to address the impact of  
19 the extended uprate on plant margins, and our approach  
20 this afternoon is to include that aspect in the  
21 presentation on the specific topics.

22 DR. SIEBER: The large transient testing,  
23 this is two tests, right?

24 MR. NOSKO: Yes, sir; MSIV closure, and  
25 generator load --

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1 DR. SIEBER: And maybe you could just say  
2 a sentence or so as to why you don't want to do that,  
3 because that is still an open item.

4 MR. NOSKO: Yes, sir. We have a -- if I  
5 could ask that the question be held until a later  
6 point in time. We do have a separate session that  
7 deals with that directly.

8 DR. SIEBER: All right.

9 MR. NOSKO: Okay. Thank you.

10 DR. SCHROCK: I have a question. In  
11 reading these documents, I find that to a very great  
12 extent, and perhaps more than 95 percent, are verbatim  
13 for the two plants.

14 And yet some numbers come out different  
15 here and there. This is puzzling to me, and I don't  
16 understand the reasons for these differences. I think  
17 a better starting point for me would be to tell us  
18 what are the plant specific differences that have to  
19 be dealt with.

20 The scheme as I understand it is that you  
21 have the generic evaluation done in the G.E. reports,  
22 and that leaves plant specific considerations to be  
23 dealt with on a case by case basis.

24 And what I don't find in these reports is  
25 a clear delineation of what the plant specific

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1 considerations are for each of these plants.

2 MR. HAEGER: I think that probably the  
3 best way to answer that is --

4 MR. BOEHNERT: If you could introduce  
5 yourself.

6 MR. HAEGER: Yes, I am Allan Haeger, and  
7 I work for Exelon in the licensing area. We have in  
8 our presentation pointed out differences where we  
9 think that those are significant, and we are prepared  
10 to discuss the reasons for the differences at that  
11 time.

12 That might go to what you are asking. If  
13 you would prefer to wait as we go through the  
14 presentation, there are opportunities there.

15 DR. SCHROCK: I am simply pointing out  
16 that I have difficulty digesting the material and  
17 making sense of it for this reason and a few others,  
18 but it would be helpful I think if you could tell us  
19 what he plant specific considerations are. That does  
20 not seem like an onerous request I don't believe.

21 MR. NOSKO: Well, they are sister  
22 stations, and they are both BWR-3s. The Dresden  
23 station uses an isolation condenser, for example;  
24 whereas, Quad Cities is a little bit behind Dresden,  
25 uses a RCIC system, reactor core isolation cooling

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1 system.

2 There are differences in safe shutdown.  
3 They have a safe shutdown pump at the Quad Cities  
4 station, and a separate system to address that for  
5 fire protection areas. We don't have that in the  
6 Dresden station.

7 It is things like that. But I am sure  
8 that we will be able to clarify this in the  
9 presentation, and if we fail, please bring that to our  
10 attention, and we will make sure that we get that  
11 straight.

12 DR. SIEBER: In your list of things that  
13 you are going to talk about, some of the questions  
14 that I sent in had to do with the fuel design, and I  
15 recognized that the lead safety analysis are separate  
16 from the upgrade.

17 But I would be interested in knowing a  
18 little bit more about the details of the fuel design  
19 than currently appears in the SER. Can you address  
20 that or do you plan to address that?

21 MR. NOSKO: Well, since the application  
22 for G.E. 14 fuel was a separate licensing submittal,  
23 we were not intending to address any of the specifics  
24 about the G.E. 14 fuel.

25 But depending on the questions, and

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1 depending on the proprietary nature, we might be able  
2 to.

3 MR. HAEGER: We certainly have personnel  
4 here who can speak and answer those questions.

5 DR. SIEBER: Well, it seems to me that  
6 when you extend the rating of the plant by 17 percent,  
7 other than a few balance of plant things and some new  
8 analysis that you have to do, everything depends on  
9 the fuel, and that is where you are getting the uprate  
10 from.

11 MR. HAEGER: That's right.

12 DR. SIEBER: And so to me I think it is  
13 part-and-parcel of it.

14 MR. HAEGER: Well, we will be covering the  
15 fuel's response to at risk to LOCA, and we talk about  
16 the general design to some degree. But I think there  
17 is enough points in the presentation that touch on  
18 that that is an appropriate place to answer questions.

19 DR. SIEBER: The ACRS doesn't get the  
20 opportunity to review safety reload, safety  
21 evaluations, and so we may miss out on the full  
22 understanding of just exactly what the uprate is all  
23 about, and how you achieve it, and everything that is  
24 affected.

25 Because you actually affect a lot of

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1 things when you change the fuel parameters. It  
2 changes the results and the results virtually of all  
3 the safety analyses as I see it.

4 Well, let's see what you do, and to the  
5 extent that you miss the questions that I submitted,  
6 then I will ask them at the appropriate time.

7 MR. NOSKO: Okay. This next slide is a  
8 power-to-flow map, and you are very familiar with  
9 this. We have a chart over there that is not as  
10 visible as we had hoped that it would be and our  
11 apologies.

12 From this chart, you can identify the  
13 current hundred percent power level, and the power  
14 level for uprated conditions, the 2957, and that is  
15 the far upper right.

16 DR. FORD: Can I ask about this chart? I  
17 mean, this chart -- well, what does it depend on? It  
18 depends upon what?

19 MR. NOSKO: Core flow.

20 DR. FORD: It depends upon the fuel  
21 design, and the way the flux is flattened, and so on?  
22 Or is it something much more basic than that? Does  
23 this middle upper boundary move around as you change  
24 the way in which you fuel the reactor, or design your  
25 flux distribution and so on?

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1 MR. NOSKO: Jens or Jason, would you help  
2 us with that.

3 MR. POST: Yes, this is Jason Post of G.E.  
4 The MELLLA upper boundary is a licensed limit, and  
5 that does not change. That is fixed in space, and  
6 that does not change from reload to reload.

7 There can be small variations in the load  
8 lines as a result of the core design, but the changes  
9 are pretty small, and we have equations that we use  
10 when we define those, and they basically don't change  
11 significantly from cycle to cycle.

12 DR. FORD: Thank you.

13 DR. SCHROCK: I saw those equations and  
14 they look like empirical relations. They don't seem  
15 to relate to any physical aspect of the plant. I  
16 think that I would like to ask the question that  
17 Graham just asked again. What is the basis of the  
18 line? How does it come to be where it is as a  
19 licensing limit?

20 MR. PAPPONE: This is Dan Pappone of G.E.  
21 The rod lines that are shown on the power flow map did  
22 have their origination back in the plant design plant  
23 response, but we have fixed those in licensing space.

24 So they approximate what the actual  
25 response would be, but we are treating these as

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1 licensing boundaries. So that helps.

2 MR. NOSKO: So you are right; they are  
3 empirical.

4 MR. POST: It is an empirical bounding fit  
5 to an original set of calculations, and having done  
6 that original fit, we are now drawing that line and  
7 saying this is our licensing boundary, and we will not  
8 allow a plant operation outside of that boundary.

9 DR. SCHROCK: But if I am not mistaken,  
10 that is one of the unexplained differences between  
11 Quad Cities and the Dresden plants. These power flow  
12 maps are not identical, and they differ significantly  
13 I think. Is that right?

14 MR. PAPPONE: I believe that we kept the  
15 power flow maps the same, or what we are counting as  
16 a licensed power flow map, and I believe that is the  
17 same.

18 MR. NOSKO: For the uprate, yes. That's  
19 correct.

20 MR. PAPPONE: For the uprate, yes.

21 MR. NOSKO: Today they have differences in  
22 their licensed power levels. Dresden is 27 (sic)  
23 megawatts thermal for their license level; and Quad  
24 Cities is 2511. So there are some differences there.

25 DR. SCHROCK: And that is an affirmed

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1 power?

2 MR. NOSKO: Correct. And when we go to  
3 the uprate power, we are bringing those two together  
4 as part of maintaining a common configuration  
5 management.

6 DR. SCHROCK: Well, I will have to look  
7 again, but in searching for what are the differences  
8 between these two reports, two sets of reports, I was  
9 struck by the fact that here were different numbers,  
10 different positioning of various lines -- this little  
11 dashed line, which has something to do with natural  
12 circulation, was in a different place.

13 But the numbers in the table that  
14 characterize where the lines are seem to be different  
15 also in Quad Cities and in the Dresden reports, SERs.  
16 So we will have to look again to confirm if I am right  
17 or am I wrong.

18 MR. HAEGER: What we will do is we will  
19 look closely at those, and try to explain any minor  
20 differences, and I think they are probably minor, but  
21 any differences in those.

22 MR. NOSKO: Okay. And the purpose of this  
23 slide frankly was to demonstrate that MELLLA allows us  
24 to operate at higher power levels without changing  
25 core flows.

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1           The next slide summarizes differences in  
2 key operating parameters between plants today and what  
3 we expect after the uprate in Dresden.

4           CHAIRMAN WALLIS: And you talked about  
5 flow rate just now. The flow rates on this diagram  
6 are not the same as they are either for Quad Cities or  
7 for Dresden on page 115 on the G.E. safety analysis  
8 report.

9           And I don't know what the differences are  
10 due to, and Quad Cities shows 105.8 for its full power  
11 core flow range maximum; and Dresden shows 98. I  
12 don't know why they are different, and yet Dresden  
13 shows 105.8 for its extended power uprate, which is  
14 not on yours either. And these are different numbers,  
15 and I just don't understand why they are so different.

16           MR. HAEGER: I think I can handle that.  
17 The full power expected core flow for both stations is  
18 going to be as shown here, 98 million pounds mass per  
19 hour.

20           Now, Quad Cities currently is licensed to  
21 achieve what they call increased core flow, which is  
22 to go beyond the right boundary of the power flow map  
23 into that increased core flow region. Dresden is not.

24           For the power uprate, we did some of the  
25 analysis, and it was stated that we did some of the

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1 analysis for Dresden at that increased core flow range  
2 to support future potential licensing actions. But  
3 the full power, 100 percent core flow for both  
4 stations will be the same at 98.

5 CHAIRMAN WALLIS: This is one of the  
6 things that is confusing when you see different  
7 numbers in different places for the same thing, and it  
8 needs some explanation.

9 MR. HAEGER: Well, we do analysis -- and  
10 you are going to see a few more differences.

11 CHAIRMAN WALLIS: So it is true then is it  
12 that you are not extending the core flow rate with  
13 this application, but that you would like to do so  
14 sometime in the future, which is why you have some  
15 higher numbers in some of these other places?

16 MR. HAEGER: That's correct.

17 CHAIRMAN WALLIS: Thank you.

18 MR. NOSKO: Quickly summarizing some of  
19 these high points, the Dresden station, I mentioned  
20 thermal power is increasing from 2527 to 2957  
21 megawatts thermal, and Quad Cities is going from their  
22 current 2511 to their same updated level.

23 Steam flow is increasing from about 9.8  
24 million pounds per hour to just over 11.7 million  
25 pounds per hour. And as you saw in the power flow

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1 map, the range of core flow at full power decreases  
2 somewhat under uprated conditions, but maximum flow  
3 through the core is not changing.

4 And you can also see here that we are not  
5 changing dome pressure or --

6 CHAIRMAN WALLIS: The core flow rate has  
7 to have a range because of condenser temperature  
8 variations or something to get the same power; is that  
9 why it varies?

10 MR. NOSKO: The range on the -- you are  
11 talking about full power?

12 CHAIRMAN WALLIS: Why is there a range?  
13 Why isn't it just 98? Why is it 85 to 98?

14 MR. NOSKO: It is a function of the MELLLA  
15 line, where the MELLLA line intersects full power.

16 CHAIRMAN WALLIS: Oh, it is the flat part.

17 MR. NOSKO: Yes. Moving on, this uprate  
18 will be accomplished in one phase. Mr. Bohlke  
19 mentioned earlier in his presentation that plant  
20 modifications will be installed during the next  
21 refueling outage for each unit, and in the on-line  
22 period immediately preceding that refueling outage.

23 I mentioned earlier that we will be taking  
24 advantage of installed spare capacity at the stations.  
25 These spares are maintenance spares for the plant, and

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1 the most obvious example that we have is that we will  
2 be operating all four of our condensate booster pumps,  
3 and all three of our motor driven reactor feed pumps.

4 But I should say also that the use of all  
5 installed feed and condensate pumps is common in the  
6 industry, and it is just a difference for Exelon at  
7 this time.

8 Following the uprate, our units will be  
9 generator limited, which means that we will be varying  
10 reactor power seasonally to account for temperature  
11 differences so that we maintain maximum output from  
12 the generators.

13 And this slide also shows our schedule for  
14 implementing the uprates at the four units. Dresden-2  
15 is in its outage now, and the remaining three units  
16 will undergo their outages for the uprate next year.

17 Turning now to the modifications that we  
18 will be making to the station. You will find that the  
19 power uprate generally requires the same modifications  
20 to be made at both stations. There are relatively few  
21 safety related modifications, and the majority of the  
22 changes are being made to the balance of plant  
23 systems.

24 CHAIRMAN WALLIS: I am going to ask you a  
25 question, because I don't see it in your presentation

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1 here. The method for increasing the power without  
2 raising the flow rates through core and the pressure  
3 and so on is flux flattening essentially.

4 So what we have seen is that you have a  
5 higher flux than you would have had before at the  
6 outside of the assemblies of the core. And yet I  
7 understand that the fluence, the vessel fluence, goes  
8 down with a power uprate. How do you achieve that?

9 MR. NOSKO: Well, we are prepared to  
10 discuss that.

11 CHAIRMAN WALLIS: Well, I didn't see it in  
12 your presentation.

13 MR. NOSKO: It is there.

14 CHAIRMAN WALLIS: It is there? Okay.

15 MR. HAEGER: It is slightly touched.

16 CHAIRMAN WALLIS: So you are going to  
17 answer that question later then?

18 MR. HAEGER: Yes, sir.

19 CHAIRMAN WALLIS: Thank you.

20 MR. NOSKO: I would like to talk about the  
21 more significant plant changes that we will be making  
22 for the uprate, using the chart behind Mr. Haeger as  
23 a rough guide.

24 That chart over there is a very simplified  
25 schematic of the steam and feed water cycles. I will

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1 begin in the upper left-hand corner with the changes  
2 to the reactor internals, and then follow that diagram  
3 in a clockwise manner through the turbine, the  
4 condenser, through the feed water system, and then  
5 back to the reactor.

6 So starting with the reactor. New G.E. 14  
7 fuel assemblies will replace existing G.E. and  
8 Siemens's fuel. This will be done gradually over 3 to  
9 4 operating cycles, and this new fuel type will allow  
10 us to reach the higher EPU power levels, while  
11 maintaining a 24 month operating cycle.

12 Mr. Bohlke mentioned that Dresden and Quad  
13 Cities are BWR-3 units. As such the steam dryers are  
14 smaller than those of the later designed BWR-4s, 5s,  
15 and 6s, and they are not able to handle the increased  
16 steam flow of an extended power uprate as well.

17 So to prevent the higher moisture  
18 carryover levels predicted for the uprate, we elected  
19 to modify the steam dryers to keep those levels to no  
20 greater than what they are today.

21 We are adding clamps to 8 of the 20 jet  
22 pump sensing lines to eliminate a concern for  
23 potential vibration induced failure of those lines  
24 caused by the vein passing frequency of the  
25 recirculation pumps.

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1           A reactor recirculation system runback and  
2 the low SCRAM level set point change are being added  
3 to improve station availability. Today, only two of  
4 the three feed pumps and 3 of the 4 condensate pumps  
5 operate at rated power.

6           If one pump trips, the standby pump  
7 automatically starts. After the uprate, we won't have  
8 a standby pump, and so we are adding a run back  
9 feature and a SCRAM set point change to prevent low  
10 water level SCRAM on either a loss of a single feed  
11 pump or a single condensate pump.

12           Changes to the isolation condenser time  
13 delay relay at Dresden and to the low pressure coolant  
14 injection swing bus timer at both times are being made  
15 to reflect new accident analyses for the extended  
16 power uprate. And we are also making some changes to  
17 set points on nuclear instrumentation.

18           DR. SIEBER: Before you leave that, what  
19 is your guaranteed maximum moisture content at the  
20 reactor outlet right now? Is it one percent?

21           MR. NOSKO: Currently today?

22           DR. SIEBER: Yes.

23           MR. HAEGER: The acceptance test for the  
24 original steam dryers was less than .2 percent.

25           DR. SIEBER: So, .2?

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1 MR. HAEGER: Yes.

2 DR. SIEBER: And what modifications are  
3 you making to the dryers?

4 MR. HAEGER: We have a couple of slides on  
5 that later in the presentation that show an insertion  
6 of a perforated plate.

7 DR. SIEBER: Is that going to change the  
8 pressure drop?

9 MR. HAEGER: That is going to change the  
10 pressure drop.

11 DR. SIEBER: Do you know by how much?

12 CHAIRMAN WALLIS: Well, the higher flow  
13 rate will change the pressure drop, too, right?

14 MR. NOSKO: Right.

15 CHAIRMAN WALLIS: So you actually have a  
16 lower pressure at your turbine than you would like or  
17 that you have now?

18 MR. NOSKO: Than we have now, yes. I  
19 don't have that specific piece of data, but I am sure  
20 that we will collect it.

21 DR. SIEBER: Right.

22 MR. NOSKO: Okay. So moving on to the  
23 turbine generator system modifications, we are making  
24 changes to our high pressure steam path by installing  
25 new high pressure turbines, and we are also changing

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1 the cross-around relief valve set points.

2 An additional steam line residence  
3 compensator card is being installed in our electro  
4 hydraulic control circuitry to handle the third level  
5 harmonic for the steam piping system.

6 And at Dresden, we found that the existing  
7 isolated phase bus up cooling system was not  
8 adequately sized to handle the uprate, and so we are  
9 making a change to improve the cooling capacity of  
10 that system.

11 DR. SIEBER: You are putting in a new  
12 return line?

13 MR. HAEGER: Yes, we are. We are putting  
14 in a new return line, and we are having all the  
15 cooling go down all three of the phases.

16 DR. SIEBER: And you aren't doing anything  
17 to the generator to improve cooling I take it or are  
18 you?

19 MR. HAEGER: We are increasing the flow of  
20 standard water cooling to the generator, but it is a  
21 small issue. I didn't include it int his  
22 presentation.

23 DR. SIEBER: And how are you doing that?  
24 You aren't changing anything. Does that take cooling  
25 water away from other components in the plant and make

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1 that system marginal? Is that just a turbine plant  
2 closed cooling water system?

3 MR. HAEGER: Yes, and that has been  
4 evaluated.

5 DR. SIEBER: And you have enough capacity?

6 MR. HAEGER: Actually, standard water  
7 cooling is service water.

8 DR. SIEBER: Service water?

9 MR. HAEGER: Yes.

10 DR. SIEBER: Well, that is still a closed  
11 cooling system, and you can't put service water there.

12 MR. NOSKO: You are correct. Standard  
13 cooling is the closest one. And I didn't mention, but  
14 Quad Cities doesn't have this problem. This is a  
15 Dresden-unique situation.

16 Continuing now with changes to the  
17 condensate and feed water systems. The increased flow  
18 from the uprate causes additional stresses on the  
19 condenser tubes, particularly in cold weather.

20 Several years ago, the Quad Cities station  
21 installed intermediate bracing for their condenser  
22 tubes to eliminate a concern that they had over tube  
23 vibration. Dresden did not at that time. So now we  
24 are making that change at the Dresden station as a  
25 part of this uprate.

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1 DR. SIEBER: Have you noticed damage at  
2 the current levels to condenser tubes on expanded  
3 vibration?

4 MR. NOSKO: No, sir, not at the Dresden  
5 station, and Quad Cities, after they went through  
6 this.

7 DR. SIEBER: And what kind of tubes are  
8 they? Do you know?

9 MR. NOSKO: They are stainless.

10 DR. SIEBER: Stainless? Okay. But you  
11 are expecting that the potential for vibration due to  
12 the increased exhaust flow will cause damage?

13 MR. NOSKO: Well, we are expecting that if  
14 it is staked at the present station, and the stakes  
15 that we have at Quad have been evaluated for the  
16 increased steam flow and they are adequate.

17 DR. SIEBER: Right. That is a time  
18 consuming modification to put all of those things in  
19 there, and there are tons of them.

20 MR. NOSKO: Yes. The increased condensate  
21 and feed water flow also requires us to increase the  
22 capacities of the condensate demineralizer systems at  
23 both stations. Dresden and Quad Cities use four  
24 stages of feed water heating.

25 The uprate increases extraction steam flow

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1 from the low pressure turbines to the feed water  
2 heaters, and this raises the internal pressure of the  
3 heaters.

4 For our two lowest pressure feed water  
5 heaters, that pressure increase is small enough so  
6 that the heaters will continue to operate within their  
7 existing design rating.

8 This is not the case for our two highest  
9 pressure heaters, and so we are making modifications  
10 to allow us to increase the pressure ratings of those  
11 heaters.

12 We are increasing the capacity of the  
13 bravo heater and normal drain valves at the Dresden  
14 station to maintain heater normal water level control,  
15 and avoid the need to bias open our emergency spills.

16 Because of similar changes already made at  
17 the Quad Cities station that modification isn't needed  
18 there. A change that is being made at the Quad Cities  
19 station, but not at Dresden, is the staggered feed  
20 pump low suction pressure trips.

21 Right now at Quad Cities all the reactor  
22 feed pumps trip on a low suction pressure signal, and  
23 after the uprate, they will be staggered somewhat,  
24 depending on the duration of that low pressure signal.

25 And separately from the extended power

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1 uprate project, a new digital feed water control  
2 system is being installed at the Quad Cities station.  
3 It of course will be tested and adjusted to support  
4 planned uprated conditions.

5 And then there are plant changes that  
6 don't neatly fit into any of the previous categories.  
7 The results of the piping analyses require us to make  
8 some changes to our main steam and torus-attached  
9 piping supports, as well as to some drywell support  
10 steel.

11 We are upgrading the interrupting  
12 capability of the non-safety related 4kV switchgear to  
13 handle the additional running loads. A feature to  
14 trip the delta condensate pump in the event of a loss  
15 of coolant accident is being added to retain the  
16 ability to make up with feed water.

17 And the Dresden station uses a cooling  
18 lake and supplemental cooling towers to cool the  
19 circulating water. We have plans to install new  
20 cooling towers at the Dresden station to install, or  
21 excuse me, to handle the additional heat load from the  
22 uprate.

23 But this is an economic decision driven  
24 primarily to avoid derating the plants in the summer  
25 months. Depending on the results of more recent

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1 economic evaluations, we may elect to defer  
2 installation of those additional cooling towers to a  
3 later date.

4 While we are prepared to go on to selected  
5 analyses and evaluations, I thought I would ask the  
6 committee if there are no further questions on the  
7 modifications?

8 DR. SIEBER: I have a couple of questions.  
9 Because you are now operating your installed spares as  
10 to provide sufficient pumping capacity, that creates  
11 a problem with your unit auxiliary transformer and its  
12 spare; where when you get a bus transfer, you end up  
13 with more load on the spare transformer than it is  
14 rated for.

15 And you have addressed that in a number of  
16 ways, one of which was to test the circuit breaker for  
17 interrupting capability. I presume that test is  
18 complete and satisfactory?

19 MR. NOSKO: Yes.

20 DR. SIEBER: And another thing that you  
21 did was to cut out the instantaneous over current  
22 protection so that you would end up with a six cycle  
23 delay or something like that?

24 MR. NOSKO: Yes.

25 DR. SIEBER: What was the basis of doing

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1 that? Was it because the peak was too high?

2 MR. HAEGER: I believe that is the case,  
3 yes.

4 MR. NOSKO: Right now I am not sure  
5 whether it is the interrupting or the instantaneous.

6 DR. SIEBER: It is the instantaneous that  
7 was cut out, and the long term one is designed to  
8 allow you to start motors where the current one would  
9 go above the operating current, and as the motor  
10 starts to the normal operating current.

11 The instantaneous one is for short-circuit  
12 protection, which now if you have a bolt short in your  
13 system, you have no protection. So when you close on  
14 it --

15 MR. HAEGER: As I understand it, the  
16 equivalent protection is obtained by the other relay  
17 scheme in there that is maintained, but I am not an  
18 electrical expert. Is there anybody back there that  
19 can help with this?

20 MR. KLUGE: Yes, I am Mark Kluge from  
21 Exelon. The test that was performed actually used the  
22 short-circuit current and then with some modifications  
23 to the switch gear bracing, and the switch gear then  
24 proved capable of interrupting that, even with the six  
25 cycle delay.

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1 DR. SIEBER: The question is not whether  
2 the circuit-breaker can interrupt it, but whether the  
3 transformer can take that fault, because the  
4 protection is gone.

5 MR. HAEGER: Yes, and I am pretty sure  
6 that the answer lies in the equivalent protections in  
7 the other features of the release scheme. Let us  
8 confirm that for you.

9 DR. SIEBER: Okay. Now, the other part of  
10 that is that you end up with a required manual  
11 operator action to eliminate or disable some of the  
12 loads on that transformer to bring it back to its  
13 current rating.

14 And I take it that the effect of the  
15 operator not doing some stripping on those buses would  
16 lead to damage to the core or to the windings of the  
17 transformer and cause overheating.

18 And you say if he does it within an hour  
19 everything is just perfect, and where did the one hour  
20 come from?

21 MR. NOSKO: We had a separate evaluation  
22 conducted.

23 DR. SIEBER: Yes, I have read that, and  
24 they said one hour, and the question is how did they  
25 come up with that? What was the basis?

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1 MR. NOSKO: The basis? I need to --

2 DR. SIEBER: Or is that engineering  
3 judgment?

4 MR. NOSKO: No, sir, it was based on the  
5 test results.

6 DR. SIEBER: Well, it takes the life out  
7 of the transformer when you do that.

8 MR. HAEGER: That's correct. We  
9 understand that to be the case, but as far as the  
10 specific basis, I think we are going to have to get  
11 back to you on that.

12 CHAIRMAN WALLIS: One hour sounds like a  
13 rounded-off number in some way.

14 DR. SIEBER: It certainly does. It should  
15 have been 58 minutes, and then we would believe it and  
16 not ask the question.

17 MR. HANLEY: This is Tim Hanley from  
18 Exelon. I believe the one hour actually came from me.  
19 I am the operations representative and I had them  
20 evaluate it at one hour because I thought that was an  
21 acceptable time period for which the operators to take  
22 those actions.

23 So it was a backward calculation on would  
24 it be okay from an hour. So I believe that is why it  
25 is such a round number.

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1 DR. SIEBER: Let me ask since you are the  
2 operating person, you probably know this. Does Exelon  
3 or its predecessor have a practice of looking at  
4 transformer gas composition?

5 MR. HANLEY: Absolutely.

6 DR. SIEBER: How often do you do it on  
7 that transformer; do you know?

8 MR. HANLEY: We take oil samples to  
9 measure the gas content I believe on a monthly basis  
10 on all of our large power transformers. So, in an  
11 event like this, if we knew that we had over duty on  
12 the transformer for some period of time, we would  
13 immediately go out and take another sample and check  
14 for gasing.

15 But we do have an analysis program that we  
16 do on a regular basis for all the large power  
17 transformers at the plant.

18 DR. SIEBER: And if somebody from your  
19 laboratory came back and said you have got high  
20 acetylene in this transformer, what would you do as an  
21 operator?

22 MR. HANLEY: It depends on the level at  
23 which it comes back at. We trend that. In fact,  
24 Dresden this past summer had a transformer that was  
25 gasing and they trended it over time, and did a

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1 control plant shutdown, and shut down, and went in and  
2 repaired the transformer and brought the unit back on-  
3 line.

4 DR. SIEBER: Why would it be a shutdown?

5 MR. HANLEY: You would have to with the  
6 unidox transformer, because it is tied directly to the  
7 generator. There is no way to separate it without  
8 taking the unit off-line.

9 DR. SIEBER: Thank you.

10 MR. NOSKO: Moving then to the selected  
11 analyses and evaluations. A full scope of the  
12 evaluations was performed in accordance with the  
13 ELTRs. These analyses were used to prove methods  
14 within previously accepted ranges and in all cases the  
15 results were within the acceptance criteria for the  
16 planned EPU configuration.

17 This next slide identifies the analyses  
18 and evaluations that we will be covering; the  
19 containment, the emergency core cooling system; and  
20 thermal-hydraulic stability. We will talk about the  
21 anticipated transient without SCRAM analogies, piping,  
22 and also we will look at the effects of the power  
23 uprate on reactor internals, and the flow accelerated  
24 corrosion programs at the stations.

25 These were selected for discussion based

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1 on a request from the committee and in the case of the  
2 reactor internals, because of recent industry  
3 operating experience. And with that, I will turn the  
4 discussion over to Mark Kluge, who will begin with the  
5 review of the containment analyses.

6 DR. SCHROCK: Excuse me, but before you  
7 leave, could you say what the current licensing basis  
8 for these plants is?

9 MR. NOSKO: In terms of what, sir?

10 MR. HAEGER: Yes, can you be more  
11 specific?

12 CHAIRMAN WALLIS: That's a pretty broad  
13 question.

14 DR. SCHROCK: Right. Well, in terms of  
15 the LOCA evaluation is what I am thinking of.

16 MR. NOSKO: Those are covered in this  
17 presentation. They are summarized along with the pre-  
18 EPU and the post.

19 MR. HAEGER: Are you asking for the  
20 methodology or the --

21 DR. SCHROCK: Well, I will ask the  
22 question subsequently.

23 MR. NOSKO: Okay. Very good. Thank you.

24 MR. KLUGE: Good afternoon. I am Mark  
25 Kluge from Exelon's EPU project engineering team, and

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1 I will be discussing the containment analysis that we  
2 performed for the Dresden and Quad Cities power  
3 uprates.

4 I will cover the methodology that we used  
5 to perform these analyses, and we will look at the  
6 results for the design basis accident, and we will  
7 also look at the Mark I hydrodynamic loads, and I will  
8 summarize the conclusions of the containment  
9 analysis.

10 CHAIRMAN WALLIS: When you say design,  
11 there are several design basis accidents.

12 MR. KLUGE: The design basis accident that  
13 I am referring to is the maximum recirculation and  
14 suction line break.

15 CHAIRMAN WALLIS: The most critical one or  
16 something like that?

17 MR. KLUGE: It provides the limiting case  
18 for containment and--

19 CHAIRMAN WALLIS: Okay.

20 MR. KLUGE: A containment analysis is  
21 performed in two phases; a short-term phase, and a  
22 long-term phase. For the short-term analysis, we use  
23 the M3CPT and LAMB codes. LAMB models flow down and  
24 then M3CPT calculates the peak dry well pressure and  
25 temperature.

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1           In the long term, we use the SHEX code,  
2           which then looks at the conditions in the suppression  
3           pool. And for the Mark I hydrodynamic loads, we use  
4           the methodologies that were defined during the Mark I  
5           long-term program.

6           In all cases our EPU license power is  
7           within the range for which these codes are applicable,  
8           and we analyzed a full spectrum of break sizes and  
9           locations, and we used conservative input parameters  
10          so that we would have conservative results.

11          Moving to the next slide, the results for  
12          the design basis accident. Peak drywell pressure, you  
13          can see that when we perform the calculation with the  
14          same methodology for current conditions and uprate  
15          conditions, here is approximately a one pound rise in  
16          peak containment pressure, which is still well below  
17          the acceptance limit for these containments.

18          For drywell air temperature, again when we  
19          perform the pre-EPU and the EPU case, we have a very  
20          nominal two degree rise in peak drywell air  
21          temperature.

22          CHAIRMAN WALLIS: Now, the drywell metal  
23          temperatures.

24          MR. KLUGE: The drywell metal is designed  
25          for a temperature of 281 degrees.

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1 CHAIRMAN WALLIS: And you have to do some  
2 transient heat transfer analyses or something?

3 MR. KLUGE: That's correct, and in this  
4 case the design basis loss of coolant accident is not  
5 even limiting for the drywell metal temperature. The  
6 peak temperature that is given here, and the air  
7 temperature lasts less than 10 seconds and simply is  
8 not there long enough to eat up the drywell shell to  
9 its limit.

10 CHAIRMAN WALLIS: I read that, and I would  
11 be a little reassured if you had actually given a  
12 number to how hot it gets. How hot does it get in  
13 this 10 seconds?

14 MR. KLUGE: I believe the peak drywell  
15 temperature is in the 277 degree range.

16 CHAIRMAN WALLIS: So it is a few degrees  
17 off the limit.

18 MR. PAPPONE: This is Dan Pappone. That  
19 is a typical result that we have seen for  
20 recirculation line break analysis, and 5 to 10 degrees  
21 below the shell temperature has been 5 to 10 degrees  
22 below the design temperature.

23 MR. KLUGE: Going on to the next slide,  
24 here are the results for the suppression coolant --

25 CHAIRMAN WALLIS: Typically is it always

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1 below?

2 MR. KLUGE: Well, the reason that I said  
3 typically is that last month we did have the shell  
4 temperature slightly above, but when they went and  
5 looked at the structural evaluation for that higher  
6 temperature in the case where it did come up higher on  
7 the shell temperature, the structural analysis was  
8 still acceptable.

9 And so occasionally we have seen the  
10 drywell shell come above the 281 limit by a handful of  
11 degrees, and if we go to the next step in the  
12 structural analysis. The structural analysis results  
13 were okay.

14 DR. SIEBER: So when you say last month,  
15 Dan, you were talking about?

16 MR. PAPPONE: The Duane Arnold analysis.

17 CHAIRMAN WALLIS: The calculation and not  
18 an event. So what is the regulation? The regulation  
19 says that if it is above 281, then you have to do a  
20 detailed structural analysis or something? What does  
21 the regulation say about this structural limit?

22 MR. HAEGER: I don't believe there is any  
23 direct regulation on this. I believe that the  
24 licensing process is to set the structural limit, and  
25 then ensure that you don't achieve it; or if you do,

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1 justify a new structural limit.

2 MR. PAPPONE: This is Dan Pappone. The  
3 containment for the drywell torus shells are ASME  
4 pressure vessels, and so at that point we are working  
5 within the ASME structural codes.

6 CHAIRMAN WALLIS: So there is nothing  
7 written in some CFR document which says that 281 is a  
8 limit?

9 MR. PAPPONE: No.

10 CHAIRMAN WALLIS: I guess we can ask the  
11 staff the same question and what they think about  
12 these when we get to them tomorrow.

13 MR. KLUGE: Moving on to the suppression  
14 pool analysis. When we did a limiting analysis using  
15 the most conservative inputs from the two sites, we  
16 saw that EPU resulted in approximately a 9 degree rise  
17 in suppression pool peak temperature.

18 We used that bounding analysis, 202  
19 degrees, in the containment analysis and piping  
20 analysis. We also calculated plant specific heat  
21 suppression pool temperatures, and that was used in  
22 the ECCS and NPSH analysis, and as you can see those  
23 numbers are lower than the limiting analysis.

24 For the EPU wetwell pressure analysis,  
25 again we had a very nominal rise in peak wetwell

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1 pressure when we applied the same methodology to the  
2 pre-EPU and post-EPU case.

3 The Mark-I hydrodynamic loads, we looked  
4 at pool swell, and vent thrust, condensation  
5 oscillation, chugging, and SRV discharge loads. We  
6 ran all the limiting cases for EPU as John Nosko  
7 mentioned, and reactor pressure does not change for  
8 this uprate.

9 That is a primary driver in these  
10 hydrodynamic loads. So we found in all cases the  
11 current Mark-I load definitions remained bounding for  
12 these plants.

13 DR. SIEBER: That is for pressure and  
14 flow, as opposed to duration of the transient, right?  
15 Because there is additional energy in the extended --

16 MR. KLUGE: There is additional energy,  
17 but it was all within the original load definitions.

18 DR. SIEBER: Okay. Do you use some kind  
19 of a starter or something like that on your safety and  
20 relief help discharge lines?

21 MR. KLUGE: We have T-quenchers. In  
22 conclusion, the containment analyses we performed for  
23 EPU used accepted methods within the range for which  
24 those codes are applicable.

25 We chose conservative input parameters and

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1 all of our results were within acceptance criteria.  
2 Therefore, we conclude that containment performance is  
3 acceptable under EPU conditions.

4 If there are no questions, I would like to  
5 introduce John Freeman, of our nuclear fuels  
6 department, to talk about the ECCS-LOCA analysis.

7 CHAIRMAN WALLIS: Well, can we conclude  
8 that not only containment performance acceptable, but  
9 containment performance is not a feature which limits  
10 the amount of power uprate that you can have within  
11 the range you are considering.

12 And that you are not getting close to a  
13 limit in containment performance which is preventing  
14 you from going to, say, 3,000 megawatts?

15 MR. KLUGE: That is correct. As you  
16 observed, there is substantial margins in all of the  
17 containment acceptance criteria.

18 CHAIRMAN WALLIS: Thank you.

19 MR. FREEMAN: Good afternoon. My name is  
20 John Freeman, with Exelon Nuclear Fuel Management. I  
21 am going to discuss emergency core cooling analysis,  
22 along with Dan Pappone of General Electric.

23 Dan is going to go over the methodology  
24 and some of the acceptance criteria, and part of the  
25 approach that was used for the extended power uprate.

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1 I will go over the results and some of the  
2 conclusions that we had reached, and with that, I will  
3 turn it over to Dan Pappone.

4 MR. PAPPONE: For the for the ECCS  
5 analysis methodology, we used the SAFER/GESTR-LOCA  
6 methodology for performing LOCA analysis. We applied  
7 it as it was outlined in the ELTR, and we did  
8 basically a full scope analysis, and I will get into  
9 a little more of the particulars, because we are  
10 moving from the previous version of the code for the  
11 way we had applied it for Quad Cities, and we are  
12 essentially changing the fuel vendor of the analysis  
13 for the Dresden plant.

14 DR. SCHROCK: My question earlier about  
15 the licensing basis. I had this specific thing in  
16 mind. The current basis is also -- rests on  
17 SAFER/GESTR calculations, using the provisions of SECY  
18 83-472; is that right?

19 MR. PAPPONE: Right. Well, the current  
20 analysis for the G.E. fuel in Quad Cities.

21 MR. HAEGER: Right now Dresden uses  
22 Siemens fuel, and they have a Siemens analysis  
23 methodology.

24 DR. SCHROCK: Which is different.

25 MR. HAEGER: Yes.

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1 MR. PAPPONE: And because we are bringing  
2 the Quad Cities analysis up to date, and we are  
3 bringing Dresden into the SAFER/GESTR methodology, we  
4 did do a full-scope analysis for the plants, and when  
5 we do that analysis, we analyze the break spectrum  
6 using a nominal set of assumptions to determine the  
7 limiting break location, and limiting break size, and  
8 the limiting single failure.

9 And once we establish that, we calculate  
10 a licensing basis peak clad temperature using the  
11 required models from Appendix K. This is the process  
12 that is outlined in SECY 83-482.

13 And in order to demonstrate that licensing  
14 basis PCT has sufficient conservatism, we also  
15 calculate an upper-bound peak clad temperature for  
16 limiting nominal case.

17 DR. SCHROCK: In all of these descriptions  
18 of many analyses that have been performed, the results  
19 seem to be given in sort of a simple narrative  
20 description that things are well within the existing  
21 range or increase only by insignificant amounts, as  
22 opposed to showing us quantitatively what the results  
23 are, and what the range of investigations span, and  
24 how many there were, and things of this nature.

25 I would think that we need to hear some of

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1 those details to have a better understanding of do we  
2 buy in or don't we. Do you follow me?

3 MR. PAPPONE: Yes, I understand.

4 MR. HAEGER: We actually have some of  
5 those comparisons in our upcoming slides, but as far  
6 as --

7 DR. SCHROCK: Well, my reading of the  
8 thing is that it is a pretty broad brush description  
9 of how you comply with an existing set of regulatory  
10 limits that are imposed on you, as opposed to a  
11 technical evaluation of how the thing performs under  
12 these new conditions.

13 MR. PAPPONE: We did perform that  
14 technical evaluation.

15 MR. FREEMAN: This is John Freeman. I  
16 think I can address that. What was great about this  
17 analysis was that it gave us a chance to do a complete  
18 new analysis to cover all four of those units, and we  
19 very carefully chose all the emergency core cooling  
20 performance inputs, and we ran it before the power  
21 uprate and after the power uprate.

22 And that's where the difference is very  
23 small. With the same fuel type, all the same inputs,  
24 and the only difference being the power level for the  
25 dba, and we are going to go over this here in a minute

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1 to talk about for the dba, the temperature doesn't  
2 change that much.

3 Most of the impact due to power uprate is  
4 in the small break analysis, and we will go over that  
5 in a little bit. But we will also talk a little bit  
6 about the fuel aspect, which is something that you  
7 wanted to be discussed.

8 When we are finished, maybe you could see  
9 if you have any more questions on this.

10 DR. SCHROCK: Sure.

11 MR. PAPPONE: The prime purpose of doing  
12 the analysis is to demonstrate that the plant is in  
13 compliance with 10 CFR 50.46, and acceptance criteria,  
14 and peak clad temperature, local oxidation for wide  
15 water reaction, coolable geometry, and long term  
16 cooling.

17 We do the plant specific analysis for the  
18 peak clad temperature, and local oxidation of the core  
19 wide metal-water reaction; and coolable geometry and  
20 long term cooling we have addressed generically in the  
21 SAFER/GESTR methodology.

22 The primary parameter of interest is the  
23 peak clad temperature, and we have to keep the peak  
24 clad temperature below 2200, which is the 50-46  
25 acceptance criterion.

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1           And out of the SECY methodology, and the  
2           SECY approach, we also have to demonstrate the  
3           licensing PCT is greater than the upper bound PCT, so  
4           that we have demonstrated that licensing PCT we  
5           calculated is sufficiently conservative.

6           And then as part of the SER conditions  
7           that were imposed on the SAFER methodology, as part of  
8           that approval, we have a limit on the upper bound peak  
9           clad temperature of 1600 degrees.

10           And that was based on the test data that  
11           was supplied for the code qualification and the  
12           application methodology calculations that we had in  
13           the generic LTR for the SAFER methodology.

14           CHAIRMAN WALLIS:     You show here two  
15           different things for Appendix K and licensing basis.  
16           Aren't they the same thing?

17           MR. PAPPONE:     The licensing basis PCT is  
18           essentially a statistical summation of the nominal  
19           Appendix K, plus some additional plant variable  
20           uncertainty terms.

21           So in the practical sense, it is the  
22           Appendix K temperature, plus a small ADS. That ADS  
23           picks up a few terms that aren't in the Appendix K  
24           calculations. So it ends up being slightly higher.

25           Now, back to the actual scope of analysis

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1 that we did. We did a full scope SAFER analysis for  
2 bringing the G.E. 9 fuel, the G.E. fuel that is in  
3 Quad Cities, and we are bringing that up to the  
4 current analysis process procedures and code.

5 We are also applying the SAFER methodology  
6 to the Siemens fuel that is in both Dresden and Quad  
7 Cities. So at the end of all of this, we have got one  
8 common analysis basis for both units, and for all the  
9 fuels in the units.

10 We did all of the analyses, the full break  
11 spectrum analyses, assuming G.E. 14 fuel, because that  
12 was the hottest fuel that we were looking at. That  
13 was fuel that was giving us the highest temperatures.

14 DR. SIEBER: That is 10 by 10 fuel?

15 MR. PAPPONE: That is a 10 by 10 fuel.

16 DR. SCHROCK: And that is an equilibrium  
17 cycle?

18 MR. PAPPONE: When we do the analysis, we  
19 are assuming an equilibrium loading.

20 CHAIRMAN WALLIS:

21 DR. SCHROCK: And you have a basis for  
22 concluding that that is the worst situation?

23 MR. PAPPONE: Yes. During the -- the two  
24 places that we look at a transition, versus  
25 equilibrium core, and during the initial blow down and

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1 core flow coast down that would affect the boiling  
2 transition time, that is once place that could be  
3 affected.

4 And then the other places during the  
5 reflooding. The fuel bundle design is such that it is  
6 hydraulically compatible. There isn't much of a  
7 difference in one fuel bundle to the next, because  
8 they have got to be able to co-exist and intermixed  
9 core

10 So there is very little hydraulic  
11 difference between the two, and you put a bundle in  
12 that has a lot higher resistance, or otherwise it will  
13 be starved and be too limiting locally, where we can't  
14 put in a bundle that has got a low resistance that  
15 will steal flow from the existing bundles.

16 So we tend to even things out that way,  
17 and then the operating limit CPR will take care of any  
18 small differences from one bundle to the next one, and  
19 fuel type to the next.

20 DR. SCHROCK: For your peak clad  
21 temperature, your decay power is certainly a  
22 consideration, and so the different points in the life  
23 of the core and the refueling changes, and all of  
24 those considerations, I guess my questions would have  
25 been more appropriate a year ago when we were talking

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1 about the generic aspect of the thing.

2 I tried to ask it then, and I didn't get  
3 a very satisfactory answer, but my knowledge of it  
4 doesn't come really from discussions in these current  
5 meetings. It comes from more than 10 year old memory  
6 of discussions that we had when that methodology was  
7 bring developed.

8 MR. PAPPONE: Right.

9 DR. SCHROCK: I really think that you owe  
10 an explanation of how these changes in the fuel  
11 characteristics impact what you have done to come to  
12 the methodology that is employed in applying the ANS  
13 standard to get the decay power curves that you are  
14 using in these analyses.

15 And they must be different now than they  
16 were when they were developed for the original cores  
17 that existed 15 years ago.

18 MR. PAPPONE: The key assumption for the  
19 decay heat is that we are using a nominal -- say mid-  
20 cycle exposure, and when we are doing the upper bound  
21 calculation, we do have the two sigma uncertainty on  
22 there.

23 DR. SCHROCK: But how do you get to that,  
24 that's what I am talking about, and my recollection of  
25 it is that you took a lot of different core

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1 compositions typical of what would occur in the life  
2 of the core, and you calculate the K-power using the  
3 ANS standard, and you evaluate the uncertainty using  
4 the uncertainty values given there for those  
5 conditions that you did a Monte Carlo evaluation.

6 And it came to some kind of generic curve,  
7 which was then applied essentially in all of the many  
8 evaluations that you have described here, for example.  
9 But it would be a different one now than it was then.

10 MR. PAPPONE: No, we have not gone back  
11 and revisited that Monte Carlo analysis. I am not  
12 aware that that Monte Carlo analysis being directly  
13 applied in the SAFER world.

14 DR. SCHROCK: You are not aware of that?

15 MR. POST: I don't think that ever was  
16 directly used in the SAFER world.

17 MR. HAEGER: You are talking about the AMS  
18 standard decay heat curve.

19 MR. PAPPONE: No, G.E. did an analysis on  
20 decay heat sensitivity, where we did go and look  
21 through --

22 DR. SCHROCK: You see, what I understand  
23 that I am talking about gets at the difficulty that  
24 arises when something has been approved, and the  
25 industry can utilize that approval to move ahead and

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1 use that methodology and satisfy regulations in that  
2 way.

3 And I accept the fact that that exists,  
4 and it is a fact of life, and it is probably  
5 necessary. But we are looking at the technical site  
6 of the thing here, and we want to understand are the  
7 conclusions that are being reached reasonable  
8 conclusions.

9 Now, I find it difficult to come to grips  
10 with answering the question when confronted with a  
11 situation where many of the details that I think are  
12 necessary just don't appear in the discussions.

13 MR. PAPPONE: We have just recently looked  
14 at the decay heat curve that we are using in the SAFER  
15 analysis, and come up with a new one for the -- we  
16 took a little bit different approach this time. We  
17 had been going through and looking at the core average  
18 exposure of the fuel types, and the operating cycle  
19 link.

20 And coming up with a bounding decay heat  
21 value based on those parameters that would go into  
22 this the 79 model. We have been using that in the  
23 containment analysis, because that analysis is one  
24 where we look at each individual part and make sure  
25 that each individual component is conservative.

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1           So out of that family of curves that we  
2           have developed for the power uprate containment  
3           analyses, gone back and compared that with the decay  
4           heat curve that we are using in the SAFER analyses.

5           And on a nominal basis, considering that  
6           we are going from mid-cycle to end-of-cycle exposure,  
7           given those differences, the decay heat that we are  
8           coming up with now, that bounding envelope, is maybe  
9           a half-a-percent higher than what we had in the  
10          original SAFER curve.

11          DR. SIEBER: Could I make an attempt to  
12          ask about the Appendix K --

13          MR. PAPPONE: I haven't even gotten to the  
14          Appendix K yet. The other pieces in the SAFER  
15          methodology, the licensing basis PCT, is based on an  
16          Appendix K PCT calculation, and that includes the 71  
17          decay heat, plus 20 percent.

18          So we have a large chunk of conservatism  
19          that we are introducing in the licensing PCT  
20          calculation.

21          DR. SCHROCK: And that is done at the end  
22          for what you have established as the worst situation?

23          MR. PAPPONE: Right. But what we have  
24          done in looking at these containment decay heat  
25          curves, and comparing to what we are using today in

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1 SAFER, we are very close. So I hope that answers your  
2 question.

3 DR. SCHROCK: I hear what you are saying,  
4 and I am not saying that I don't believe it, but what  
5 I am saying is that I haven't seen the backup details  
6 that make it totally convincing to me.

7 DR. SCHROCK: I understand.

8 DR. SIEBER: Maybe we could back up for a  
9 second to the second bullet. When you read that off,  
10 you made a statement that I think I misunderstood,  
11 which was you chose to use G.E. 14 fuel because it is  
12 the hottest fuel?

13 MR. PAPPONE: Right.

14 DR. SIEBER: I would think you mean in  
15 comparison to 9-by-9 fuel?

16 MR. PAPPONE: Yes.

17 DR. SIEBER: I would think that it would  
18 be the other way around, because you have more surface  
19 with 10-by-10 than you do with 9-by-9.

20 MR. PAPPONE: If we look at 9-by-9  
21 bundles, or why don't I take the G.E. 9 8-by-8 bundle  
22 if it is in there.

23 DR. SIEBER: Okay.

24 MR. PAPPONE: We have got the maximum  
25 linear heat generation rate that we are allowed is

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1 14.4 kilowatts per foot.

2 DR. SIEBER: Right.

3 MR. PAPPONE: But we have only got 62 fuel  
4 rods, and they are depending on -- well, we have got  
5 60 fuel rods in there. If we look at the G.E. 14  
6 bundle, its maximum LHGR is 13.4 kilowatts per foot,  
7 a kilowatt per foot lower.

8 But we have gone to 92 fuel rods in there,  
9 and so if we look at the power remaining slice, we  
10 have got a lot more power.

11 DR. SIEBER: The density is --

12 MR. PAPPONE: Right. The total power is  
13 higher.

14 DR. SIEBER: But the PCT should be lower,  
15 right?

16 MR. PAPPONE: Well, the PCT is --

17 DR. SIEBER: Or what is the point of going  
18 to the 10-by-10 fuel?

19 MR. PAPPONE: It can pack more energy into  
20 that bundle.

21 DR. SIEBER: For a given set?

22 MR. PAPPONE: For the nuclear site, yes.

23 DR. SIEBER: For thermal conditions?

24 MR. PAPPONE: Right. And PCT is primarily  
25 driven by the LHGR, but the average planer power is

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1 also secondary, but still significant, input.

2 So, yes, we would expect if we went and  
3 looked at an 8-by-8 bundle, and dropped the LHGR, we  
4 are going to see a large drop in the PCT, a  
5 significant drop. But because we have gone to almost  
6 half again as many fuel rods in that plane, the power  
7 is up about 12 or 13 percent, 12 or 15 percent higher.

8 DR. SIEBER: Well, it should be up 17  
9 percent if that is what your core average power  
10 increase is. But your surface probably only goes up  
11 10 percent, right?

12 MR. PAPPONE: When we do the analysis, we  
13 put that hot node -- the hot rod and the hot node  
14 right on its LHGR limit.

15 DR. SIEBER: Okay.

16 MR. PAPPONE: So that doesn't move around.  
17 The hot bundle power that we use in the analysis  
18 doesn't change. The average bundle power will change  
19 with the power uprate.

20 But when we put that hot node on full  
21 power, that is when I am saying the power level is  
22 about 12 to 13 percent higher for that node. So we  
23 end up with a little higher PCT because of that.

24 DR. SIEBER: Thank you. That clarifies  
25 that for me.

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1 MR. HAEGER: We didn't finish this slide  
2 I don't think.

3 MR. PAPPONE: Okay. So we did all of the  
4 analyses for G.E. 14 fuel type, and the full break  
5 spectrum, non-recirculation line break, like steam  
6 water, and feed water, and single failure evaluation.

7 And once we establish limiting cases, we  
8 went back and evaluated those limiting cases using  
9 legacy fuel types, Siemens fuel, and the older G.E. 9  
10 fuel.

11 And we also did a sensitivity study for  
12 the power uprate. We did all of these analyses at  
13 power uprate conditions. We went back and analyzed a  
14 case of current power condition, where the only  
15 changes in the analysis were the reactor operating  
16 conditions. So we had a true what is the impact of  
17 power analysis on that.

18 CHAIRMAN WALLIS: Which PCT are you  
19 showing us that you did this analysis for different  
20 fuels? Which PCT are you actually showing us?

21 MR. PAPPONE: The PCTs are the G.E. 14  
22 PCTS.

23 CHAIRMAN WALLIS: And the others are  
24 lower?

25 MR. PAPPONE: Right, except for the upper

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1 bound, we had a little larger sensitivity in the upper  
2 bound for the Siemens fuel. So the upper bound PCT  
3 that we are showing is a little bit higher than the  
4 G.E.

5 It is based on the Siemens 9-by-9 fuel,  
6 and that was a little higher than the G.E. 14 fuel.  
7 But the other temperatures are the G.E. 14.

8 DR. SIEBER: Right. Now, let me ask  
9 another question. As you march through the next 2 or  
10 3 fuel cycles, you are going to have a mixture of  
11 legacy fuel and G.E. 14 fuel, which sort of tells me  
12 that when you do your reload safety analysis, unless  
13 you do some pretty fancy things in the fuel design  
14 space, that you won't achieve the extended power  
15 uprate for a couple of cycles. Now, is that true or  
16 not true?

17 MR. FREEMAN: This is John Freeman. I  
18 think the question as I understand it was because we  
19 don't have a full core G.E. 14, we are not going to be  
20 able to achieve --

21 DR. SIEBER: Yes, and is that true or not.

22 MR. FREEMAN: No, that is not true. They  
23 are essentially operating strategies for the first  
24 reload cycle by the enrichment and the guideline  
25 choices that will allow us to hit the expected

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1 targets.

2 Now, something that you have to realize is  
3 that we are not going to be operating that unit at  
4 2957 right on the money for the whole cycle. We will  
5 be just like John mentioned. We will be cycling the  
6 reactor power up and down to meet maximum generator  
7 output.

8 So that is all factored into the reload  
9 analysis for any particular cycle. But it is done  
10 -- obviously the safety analysis is always done at the  
11 license conditions, although the energy design will be  
12 for what we expect to operate at.

13 DR. SIEBER: Now, for a two year cycle,  
14 and changing the fuel -- the number of fuel rods per  
15 assembly, I would presume that the enrichment has to go  
16 up and to control it you have to add more guidelines?

17 MR. FREEMAN: That's right.

18 DR. SIEBER: Doesn't that place more  
19 pressure on your core shutdown margin?

20 MR. FREEMAN: The core is designed to meet  
21 all of its core shutdown margin criteria.

22 DR. SIEBER: Well, I understand that, but  
23 the pressure -- the more that you go in that  
24 direction, the harder it is to guarantee to meet core  
25 shutdown requirements; is that true or not true?

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1 MR. FREEMAN: No, actually every core is  
2 designed to meet that criteria. So if the design  
3 doesn't meet the criteria, it is not used.

4 DR. SIEBER: Well, yes, I understand that.

5 MR. FREEMAN: So it is a design process.  
6 You either hit the target every time or you don't  
7 operate that particular design.

8 DR. SIEBER: Well, there is trade-offs  
9 there.

10 MR. FREEMAN: Yes.

11 DR. SIEBER: All of your fuel parameters  
12 fit in some kind of a regulatory design box, and  
13 somehow or other you have got to get it in there, and  
14 the way you do it is to spend money, right?

15 MR. FREEMAN: That's right. You have to  
16 put --

17 DR. SIEBER: That is usually one of the  
18 trade-offs. And I also would imagine that the fuel  
19 would be most reactive sometime other than the  
20 beginning of life, and obviously not at the end of  
21 life; is that true also, because it is a balance  
22 between remaining enrichment, versus remaining  
23 venerable poisons?

24 MR. FREEMAN: Where you get into the  
25 transient analysis Chapter 15 type world, which is

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1 apart from this LOCA stuff, yes, the particular core  
2 can be more reactive from a standpoint of a void  
3 coefficient, a doppler coefficient, and all of that is  
4 taken into account.

5 DR. SIEBER: So about 30 percent of the  
6 cycle lifetime is usually when it is most reactive?

7 MR. FREEMAN: It depends on the specific  
8 design and the goals that are being met for that  
9 design, and whether it is a spectral shift core, or  
10 whether it is some other goal.

11 It can change, but it is all within the  
12 approved methodology, and the operating limits and to  
13 include all of that, as well as the LHGR and upper  
14 hydro limits are all protected for any particular  
15 design. And that covers the entire exposure for that  
16 cycle.

17 CHAIRMAN WALLIS: I suspect that we are  
18 getting behind on time; is that not the case?

19 MR. FREEMAN: Yes, a little bit.

20 DR. SIEBER: I should not ask any more  
21 questions I guess.

22 CHAIRMAN WALLIS: Well, if you are getting  
23 the right answers --

24 DR. SIEBER: Well, I understand the  
25 answers.

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1 MR. FREEMAN: All right. Let's go on with  
2 this slide then. The approach as Dan mentioned  
3 calculated full spectrum as required by Appendix K.  
4 I would point out that the DBA, which is a break of  
5 the recirculation section line, was a limiting case  
6 for this analysis.

7 Of course, small breaks and other selected  
8 breaks were evaluated, and per Appendix K, the  
9 limiting single failure was determined and it is the  
10 diesel generator failure.

11 And on page 30, I will just go over some  
12 of the results that I --

13 CHAIRMAN WALLIS: I guess I thought when  
14 I read the SER that the steam line break brought the  
15 drywell air and shell temperatures very close to the  
16 limits, and yet you said --

17 MR. HAEGER: This would not be for the  
18 LOCA analysis, but for peak clad temperature.

19 CHAIRMAN WALLIS: It is peak clad  
20 temperature that is the limiting analysis, but for the  
21 containment, it may be something else.

22 MR. HAEGER: That's correct.

23 CHAIRMAN WALLIS: Now, is this true that  
24 this upper bound PCT is exactly 1600 Fahrenheit?  
25 There must be some kind of a do-loop in this program.

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1 MR. PAPPONE: Well, no. Well, actually  
2 there is a do-loop in the process, and that's where  
3 were if we do calculate a value above 1600 degrees,  
4 and we run out of fancy tricks to bring it back down  
5 to 1600 degrees, we have imposed a map of outer limit  
6 on the plant to keep the PCT below 1600 degrees.

7 In this case the calculated answer came  
8 out to be just below the 1600 degrees. What we do  
9 when we report these temperatures, we run the  
10 calculated number up to the next 10 degrees, because  
11 I don't want to say that I calculate that number to  
12 four significant factors.

13 CHAIRMAN WALLIS: Is this what determines  
14 the 2957 megawatt thermal?

15 MR. PAPPONE: No.

16 CHAIRMAN WALLIS: It's not?

17 MR. PAPPONE: Even if we had to impose a  
18 map of outer limit, and keep the fuel from going up to  
19 the 13, there is still margin in the core design world  
20 to absorb that without affecting the overall plant  
21 power uprate.

22 CHAIRMAN WALLIS: What is the upper bound  
23 PCT with the existing power level?

24 MR. FREEMAN: The upper bound PCT with the  
25 existing power level? I think I have it here.

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1 MR. PAPPONE: Do you mean current  
2 licensing basis?

3 CHAIRMAN WALLIS: Yes, current licensing  
4 basis.

5 MR. FREEMAN: I believe for Quad Cities it  
6 is below 1600.

7 CHAIRMAN WALLIS: Well, it better be, yes,  
8 but what is it? It just seems high to me. When we  
9 were looking at Duane Arnold, I don't think that we  
10 had anything like such a high PCT. Why does it come  
11 so high in this case?

12 MR. PAPPONE: I believe there is a big  
13 difference between the Dresden and Quad plants and  
14 Duane Arnold. Duane Arnold is a very small vessel,  
15 and a very small core, and as a result, when they did  
16 the plant design, they used a smaller recirculation  
17 pipe.

18 Their recirculation pipe diameter is a 22  
19 inch pipe, and Dresden and Quad Cities, and the rest  
20 of the BWR-3s and 4s, it is 28 inch pipe. So we are  
21 looking at for Duane Arnold, their break size is about  
22 60 percent of the Dresden and Quad.

23 And if we looked at the Appendix K PCTs  
24 for the two plants, if we looked at Dresden's and  
25 Quad's 60 percent and Duane Arnold's hundred percent

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1 break size, they are fairly close.

2 CHAIRMAN WALLIS: Could you get that  
3 number that I was asking about, the current licensing  
4 basis upper bound PCT? I think it ought to be on one  
5 of your transparencies, but I am not sure it is.

6 MR. FREEMAN: We will get back to you on  
7 that. Okay. I think we are on page 30. What we are  
8 looking at here --

9 DR. SCHROCK: Excuse me, but you mentioned  
10 the question of accuracy on the PCT. There is also  
11 the question of accuracy on the power level of the  
12 plant. When you talk about 1957 or whatever the  
13 number is, plus or minus what on that?

14 MR. PAPPONE: The Appendix K calculations  
15 include the 2 percent core power, and also on the  
16 linear heat generation rate, peak linear heat  
17 generation rate, and that is also factored into the  
18 initial CPR that is used in the analysis.

19 DR. SCHROCK: No, what I am asking is how  
20 accurately do you know what the true thermal power is  
21 in the plant?

22 MR. PAPPONE: Well, it is within that two  
23 percent and --

24 MR. HAEGER: That is what 90 percent is  
25 for, is the uncertainty.

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1 MR. PAPPONE: Right.

2 DR. SCHROCK: Well, that is a nominal  
3 value that was written into law a long time ago, but  
4 that isn't the true uncertainty in what you know to be  
5 the case. So what I am asking is what is your known  
6 accuracy of thermal power of the plant at any given  
7 instance?

8 DR. SIEBER: It is generally one percent,  
9 right? It comes out of a calimetric calculation,  
10 which used to be 2 percent, and that's why they put  
11 the 2 percent adder on to the core thermal power when  
12 it improved their ability to calculate that with  
13 improved flow instruments and temperatures.

14 MR. HAEGER: Right, and in fact many  
15 plants of course are taking small uprates because they  
16 are demonstrating their uncertainty --

17 DR. SCHROCK: They have reduced that  
18 uncertainty.

19 MR. HAEGER: Right.

20 DR. SIEBER: So the increment of margin  
21 that is in these calculations fully encloses the  
22 uncertainty of the calimetric calculation, at least in  
23 my opinion?

24 MR. HAEGER: Yes.

25 MR. FREEMAN: Okay. Page 30, these are

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1 the results for the LOCA analysis; a peak clad  
2 temperature of 2110 degrees, which is less than the  
3 5046 limit at 2200.

4 As Dan mentioned before, we talked a lot  
5 about the upper bound and I won't go into that  
6 anymore. The local oxidation was 6 percent, which is  
7 below the 17 percent limits for 5046.

8 Similarly, the core wide metal-water  
9 reaction was .1 percent, and it is well below the one  
10 percent limit, and of course the other 5046 criteria  
11 are met.

12 What this analysis showed that was done  
13 for the PSAR was that the effect of the power uprate  
14 on peak clad temperature was less than 10 degrees, and  
15 that is consistent with what GE has seen with other  
16 plants.

17 CHAIRMAN WALLIS: And so going back to my  
18 question before then, that means that on the current  
19 licensing basis, it is something like 50.90 something?

20 MR. FREEMAN: The current licensing basis  
21 does not have G.E. 14 fuel.

22 CHAIRMAN WALLIS: Like I was saying the  
23 EPU effect on PCT less than 10 degree fahrenheit, that  
24 presumably means upper bound PCTs is 1590.

25 MR. FREEMAN: Well, remember that we

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1 stated earlier that this comparison was done strictly  
2 with G.E. 14, and the only change being the power  
3 uprate. That was for purposes of determining what the  
4 effect on PCT was of the increase in power.

5 So with the different methods and fuel  
6 types that the other plants currently have, that 10  
7 degrees wouldn't apply that difference.

8 CHAIRMAN WALLIS: So the effect of fuel  
9 type is some other number of degrees fahrenheit, which  
10 we don't know here?

11 MR. FREEMAN: That is right.

12 CHAIRMAN WALLIS: But you are saying it is  
13 a small effect, and the message that you are trying to  
14 convey would seem to me is that EPU has small effect  
15 on PCT, and it may well be that the change in fuel  
16 type has a bigger effect than the EPU.

17 MR. HAEGER: That is precisely right.

18 MR. FREEMAN: That's right.

19 CHAIRMAN WALLIS: So we maybe ought to be  
20 discussing changes of fuel type, and that is another  
21 meeting altogether isn't it?

22 DR. SIEBER: Yes.

23 MR. FREEMAN: Yes.

24 MR. HAEGER: Yes, it is a separate license  
25 amendment request that we have before the Commission.

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1 MR. FREEMAN: Okay. Moving on to page 31,  
2 I just want to apologize for this first bullet here.  
3 It says that the EPU effect on large break LOCA, and  
4 in the subbullet, really as you mentioned, sir, it is  
5 the G.E. 14 effect on the large break LOCA that  
6 motivated us to make a set point change in the swing  
7 bus delay timer.

8 And it really wasn't the power uprate.  
9 This was something that came from the use of G.E. 14  
10 fuel, and I think that John mentioned that swing bus  
11 set point change already.

12 Whereas, the really big effect of the  
13 power uprate was on the small break LOCA and that was  
14 expected because of the higher decay heat values.

15 To summarize, before power uprate, we  
16 could afford to have one ADS valve out of service, and  
17 we could get adequate depressurization for small  
18 breaks with four ADS valves.

19 However, at extended power uprate  
20 conditions, the analysis showed that we needed all  
21 five of the five ADS valves to operate in order to  
22 keep our upper bound PCTs below the 1600 degrees.

23 CHAIRMAN WALLIS: Does this only affect  
24 the risk?

25 MR. FREEMAN: I believe the impact upon

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1 the risk will be discussed.

2 MR. HAEGER: We will be discussing that  
3 later.

4 MR. FREEMAN: Moving on to page 32. In  
5 conclusion, the emergency core cooling analysis  
6 methodology that is being used is conservative, as  
7 well as accepted by NRC.

8 The licensing basis PCT is a conservative  
9 way of calculating the result based on Appendix K  
10 models. In conclusion, after meeting all 5046  
11 criteria, the emergency core cooling system  
12 performance is acceptable at the power uprate  
13 conditions.

14 And unless there are any other questions,  
15 I will introduce Tim Hanley, and he is going to go  
16 over the thermal-hydraulic stability.

17 CHAIRMAN WALLIS: Thank you very much.

18 MR. FREEMAN: You're welcome.

19 MR. HANLEY: I am Tim Hanley, and I am a  
20 senior reactor operator at the Quad City station.  
21 Jason Post of General Electric will be talking about  
22 the background methodology and analysis results, and  
23 then I will be covering operational aspects and  
24 conclusions.

25 CHAIRMAN WALLIS: I would like to ask

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1 where we are on the presentation, and when I discussed  
2 with Exelon earlier, and we thought that we could have  
3 a break before the risk evaluation, but I noticed that  
4 we don't even seem to be about half-the-way there yet.

5 MR. HAEGER: What we thought that we would  
6 try to do is to get through the slide and all the  
7 analysis on that slide that stated the selected  
8 analyses.

9 CHAIRMAN WALLIS: Well, that will get us  
10 up to slide 70 something, and we are only to 34 now.

11 MR. HAEGER: Yes.

12 CHAIRMAN WALLIS: Can we do that in half-  
13 an-hour or 40 minutes, or something? We may have to  
14 break before we intended to break.

15 MR. HAEGER: And we can certainly work  
16 around whatever break time you want.

17 CHAIRMAN WALLIS: We are behind where we  
18 thought we would be.

19 MR. HAEGER: Yes.

20 MR. HANLEY: With that, I will turn it  
21 over to Jason Post of General Electric.

22 MR. POST: This is Jason Post. Dresden  
23 and Quad Cities are still operating with a BWR owners  
24 group interim corrective actions in place. They have  
25 -- the ICAs provide manual prevention and suppression,

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1 and they have been in operation for something over 10  
2 years now with those in place.

3 They have not yet implemented the  
4 stability solution, and the stability solution that  
5 they have selected is Option 3, and Option 3 is a  
6 robust detect and suppress solution.

7 It requires some new hardware, the  
8 oscillation power range monitor, the OPRM. The OPRM  
9 has been installed, but it has not been operational  
10 yet, partly as a result of the Part 21 notification  
11 that G.E. issued earlier, this summary of the DVOM  
12 curve.

13 It is a robust detection algorithm that  
14 looks at LPRM signals, and determines when an  
15 oscillation occurs, and if the oscillations go up to  
16 a set number of oscillations in a row, called the OPRM  
17 count, and the amplitude reaches a certain set point,  
18 and that occurs within what is called the trip enabled  
19 region, then the OPRM will give an immediate SCRAM.

20 The next slide shows the ICA power flow  
21 map, with the ICA regions on them, and the key thing  
22 to note here is that the absolute power and absolute  
23 flow on the region boundaries has not changed.

24 They have been effectively rescaled so  
25 that you maintain the same absolute power and absolute

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1 flow on those boundaries. And just the way that the  
2 ICAs work, ICA in Region 1 is an immediate SCRAM  
3 region.

4 So if they were to get a flow run back  
5 into that region, there is an immediate manual SCRAM  
6 by the operator based upon simply being in that  
7 condition.

8 It is not -- it doesn't require  
9 determining that an isolation has occurred or  
10 anything. You get an immediate manual SCRAM. Region  
11 2 is an immediate active region, and so if there is a  
12 run back into Region 2, the operator immediately  
13 inserts control rods or reduces core -- I'm sorry,  
14 increases core flow to exit that region.

15 Region 3 is called a controlled entry  
16 region, and under the Owners Group ICAs, you are  
17 allowed to enter that region if you have a stability  
18 control. For example, high core boiling boundary,  
19 which makes the core more stable.

20 And actually for Dresden and Quad Cities,  
21 they have just assumed or have included Region 3 as  
22 part of Region 2. So it makes the immediate exit  
23 region include both of those two regions.

24 CHAIRMAN WALLIS: And where does this  
25 Option 3 OPRM -- well, where does that fit in that map

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1 in terms of where it would SCRAM the reactor?

2 MR. HANLEY: That is shown on the next  
3 slide.

4 MR. POST: Let me just say that before we  
5 go to the next slide, to remember that the purpose of  
6 the ICAs is to prevent a reactor instability, and if  
7 one does occur, to have a manual SCRAM.

8 So it is drawn to be a limiting condition  
9 for where you would expect instability to occur.

10 CHAIRMAN WALLIS: I would expect the  
11 limits of his OPRM to be sort of inside the other  
12 boundaries.

13 MR. POST: It actually needs to be larger.

14 CHAIRMAN WALLIS: Larger?

15 MR. POST: Yes, it needs to be actually  
16 larger, and the reason is that because you want to  
17 make sure that it encompasses the area in which an  
18 instability could possibly occur.

19 CHAIRMAN WALLIS: Well, it encompasses it,  
20 but where you actually predict that it is likely to  
21 SCRAM the reactor is going to be a smaller region than  
22 where the operator would do it.

23 MR. POST: Yes.

24 CHAIRMAN WALLIS: Otherwise, it would  
25 always be done automatically.

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1 MR. POST: That's correct.

2 CHAIRMAN WALLIS: So the actual -- what  
3 you expected to really happen is a fairly small region  
4 up in the corner there somewhere?

5 MR. POST: Yes. If you were to draw a  
6 line of constant decay ration, and if you could go to  
7 the next slide, please. The line of constant decay  
8 ratio would be somewhere in here.

9 CHAIRMAN WALLIS: It is way up in there.  
10 Right. Right.

11 MR. POST: And so that is the reason that  
12 you would expect oscillation would actually occur, and  
13 the OPRM and trip enabled region is defined to be well  
14 outside that region.

15 Again, for the trip enabled region, what  
16 we do is rescale the region boundary so that the  
17 absolute power and flow condition is maintained the  
18 same as the pre-uprate condition.

19 MR. BOEHNERT: When is the Option 3 going  
20 to be implemented?

21 MR. HANLEY: For Quad Cities and Dresden,  
22 they will implement that when the Part 21 notification  
23 has been resolved. Even plants that have already  
24 enabled that have gone back to the ICAs as a backup  
25 because it is non-conservative in some points. So as

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1 soon as the Part 21 issue is resolved, we will be trip  
2 enabling that system.

3 MR. POST: We are working with the BWR  
4 owners group on that, and it will probably be a year  
5 from now before it is actually -- the new subpoints  
6 are defined and it is ready to go.

7 Just moving on to the next page then, on  
8 the analysis results, we did a demonstration analysis  
9 for the demonstration EPU core on the OPRM setpoint  
10 simply to demonstrate that that calculation can be  
11 performed.

12 It is a cycle specific calculation and is  
13 done for each reload. The three elements of it are  
14 the hot bundle oscillation magnitude, and that depends  
15 upon the OPRM hardware. It is unaffected by EPU,  
16 MELLLA or G.E. 14.

17 It is strictly related to the LPRM  
18 configuration. The second part is the CPR change  
19 versus oscillation magnitude, and that is known as the  
20 DIVOM curve, and that is currently being revised by  
21 the owners group and G.E.

22 And the third part is the fuel specific  
23 CPR performance and limits which are addressed in the  
24 cycle-specific analysis. So we use all those elements  
25 to calculate what the OPRM set point is that provides

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1 safety limit protection for our reactor instability.

2 CHAIRMAN WALLIS: Well, that doesn't mean  
3 anything of me at all. That is so full of acronyms  
4 and --

5 MR. POST: I'm sorry?

6 CHAIRMAN WALLIS: It didn't mean anything  
7 to me at all.

8 MR. POST: Well, I'm sorry.

9 CHAIRMAN WALLIS: I am not sure that you  
10 can make it clearer, but --

11 MR. POST: The OPRM is the oscillation  
12 power range monitor, and that is the new piece of  
13 hardware that you install specifically for Option 3.

14 CHAIRMAN WALLIS: Yes, I understand that.

15 MR. POST: And it has an amplitude sub-  
16 point, and so as the oscillation grows, it is a  
17 normalized value --

18 CHAIRMAN WALLIS: So that is on the  
19 reactor when the oscillation is big enough, and I  
20 understand that.

21 MR. POST: Yes.

22 CHAIRMAN WALLIS: But this business about  
23 the DIVOM curve.

24 MR. POST: DIVOM stands for delta CPR over  
25 initial CPR, versus oscillation magnitude. Hence the

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1 acronym, DIVOM. And that that is, is just how much  
2 does CPR change as a function of the fuel type.

3 What we found for the Part 21 when we did  
4 the Part 21 notification is that we had a generic  
5 curve, and we found out that we were a little bit  
6 overestimated in the generic applicability of that  
7 curve, and some specific factors were not fully  
8 addressed.

9 And so that resulted in the Part 21  
10 notification, and we are developing what a new DIVOM  
11 curve should be. It is likely to be more plant and  
12 cycle specific, and factor in the specific parameters  
13 that affect that curve.

14 CHAIRMAN WALLIS: Well, if you are  
15 developing something, what has that got to do with  
16 application for a license now?

17 MR. HAEGER: We should probably go back  
18 and put this in perspective. We are going to start up  
19 using interim corrective actions, which is what we  
20 have been operating on for quite some time. And what  
21 we are trying to show in this slide, number 36, is  
22 that those interim corrective actions are applicable  
23 to the EPU power level.

24 And so really until this Part 21 issue is  
25 resolved, all this discussion about the OPRM system

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1 and these DIVOM curves is somewhat moot right now.

2 CHAIRMAN WALLIS: So does that mean that  
3 we have to move on? Now, this is the drunken man's  
4 walk; is that what that is?

5 MR. HANLEY: This is Tim Hanley again from  
6 Exelon. I am going to go over some operational  
7 considerations in discussing stability. What you see  
8 on the screen now is a picture of the power flow curve  
9 with the actual data from our last Unit 2 start up.

10 Two real operational concerns when talking  
11 about thermal hydraulic stability is, first, we want  
12 to avoid entering the regions of potential  
13 instability.

14 The real concern there is do you have  
15 enough room between your cavitation interlock line  
16 down here, which is the point at which you can  
17 increase your recirculation pump speed, and the bottom  
18 of the instability region. It is quite a bit of  
19 margin and not difficult to avoid that region during  
20 the start-up.

21 So that is the initial thing that we do,  
22 and the other consideration is what do you do if you  
23 enter one of the regions of instability, or potential  
24 instability inadvertently. The recirculation pump  
25 trip is evaporating at a high flow control line at low

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1 power.

2 There is a potential if you are operating  
3 at low power, low flow, loss of heat core heating can  
4 raise your power levels in those regions. So what do  
5 you do if you get there?

6 Jason mentioned that you have two options;  
7 inserting rods or increasing flow. Neither Dresden  
8 nor Quad Cities do we have increasing flow as an  
9 option. We always insert rods to decrease your flow  
10 control line.

11 So if the operator gets in the instability  
12 regions, they will monitor for instabilities, and what  
13 they are looking for is about a two times change in  
14 the noise level on the nuclear instrumentation --  
15 SRMs, LPRMs, or ATRMs.

16 CHAIRMAN WALLIS: Well, there is nothing  
17 new about extended power about this.

18 MR. HANLEY: No, the only thing different  
19 -- and maybe since we are running behind we ought to  
20 keep it at that, but the only thing is that the  
21 potential instability region has expanded, because we  
22 are going to higher power.

23 And that area that comes off of the top  
24 there that kind of jets out is a new region of  
25 instability, and anything above our current 108

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1 percent MELLLA region is new.

2 But the operator action flow won't change,  
3 nor will the OPRM change, when we install that. The  
4 region will just be expanded. So in conclusion,  
5 really we intend to start up with the ICAs in place  
6 that we have been operating under to implement the  
7 OPRM, and trip enable that when the Part 21  
8 notification is completely settled and we can do that  
9 at the right opportunity.

10 We have rescaled the instability region,  
11 and so we have maintained our absolute levels for when  
12 we say we are entering the regions of potential  
13 instabilities, and that power uprate doesn't  
14 significantly affect how we would handle instabilities  
15 and our analysis is acceptable for power uprate with  
16 thermal-hydraulic stability. Any questions?

17 DR. SCHROCK: Maybe it is not important,  
18 but there is a curious effect here on this particular  
19 curve. It looks like you went up initially, and then  
20 you kind of dwelled for a while with rods in and out  
21 jingling a little bit. Is that the way they really do  
22 it?

23 MR. HANLEY: What you have got here -- you  
24 are talking about the 25 percent power level?

25 DR. SCHROCK: Forty percent, 40 percent

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1 flow. Well, 30.

2 MR. HANLEY: And then it is about 25 or 30  
3 percent power. WE do a lot of testing at that point,  
4 turbine testing, to verify all the turbine trip SCRAMs  
5 are all operational. So we do end up staying at that  
6 power level for a while during a start up.

7 It is also kind of jagged. I did get  
8 this, I believe, off of 15 minute increments of data.  
9 So that is why it tends to jump around. It is not a  
10 smooth curve because I didn't go to minute data.

11 But there are certain points where we  
12 spend more time due to required testing, and that in  
13 particular is the turbine testing.

14 DR. SCHROCK: Well, can the thermal power  
15 change by as much as this spread and data point shows  
16 without rod movement?

17 MR. HANLEY: Certainly.

18 CHAIRMAN WALLIS: And another question  
19 becomes how about --

20 MR. HANLEY: You are looking at flow  
21 though, right?

22 DR. SCHROCK: Well, flow is constant  
23 there, that group of points that I am looking at.

24 MR. HAEGER: I don't know that we can  
25 resolve them that clearly. The resolution isn't --

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1 MR. HANLEY: You are looking just at that  
2 little glob of points in there?

3 DR. SCHROCK: Right. Yes. I am curious  
4 about why they would stop there, and it looks like  
5 there almost was in and out rod jiggling.

6 MR. HANLEY: What you really see is the --  
7 you are getting -- depending on how long you stay  
8 there, you will begin to see some xenon build in, and  
9 so you may be pulling some rods. You may be adjusting  
10 recircs to compensate for that.

11 And like I said, during this start up, you  
12 may sit there for as much as eight hours doing your  
13 testing. So you will in fact be adjusting power at  
14 that point.

15 CHAIRMAN WALLIS: And then there is the  
16 jingling around at the hundred percent core flow, and  
17 one has to wonder how much jingling around you would  
18 do if you got to Point D in your uprate.

19 MR. HANLEY: Essentially, the way you can  
20 operate is that right now we have this band to operate  
21 in from our permanent 100 percent power out to the  
22 current 108 percent flow control line.

23 You operate on that line and adjust your  
24 recirc flow so that as your Xenon builds in, you will  
25 pull up to above the hundred percent flow control

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1 line. Zenon builds in your adjust recirc pumps to  
2 stay at that same power level.

3 The operating band we will have is  
4 actually between charlie and delta up here. So we  
5 will in fact be adjusting recirc flow at the higher  
6 power level or doing some power rod moves.

7 But we do have an operating region that we  
8 will be able to operate in so that the operators won't  
9 constantly be pulling control rods. They will be able  
10 to make slight adjustments in recirc flow and maintain  
11 full power.

12 CHAIRMAN WALLIS: But they still won't go  
13 over 2957 megawatts while they are doing that?

14 MR. HANLEY: No, we won't go over 2957  
15 megawatts, and until we do modifications to the  
16 generator, it is unlikely that we will even get there.

17 We will actually be operating at a lower  
18 thermal power level because we will be limited by the  
19 capability of the generator.

20 MR. HAEGER: But I think the point is that  
21 you do calimetrics frequently to determine that you  
22 are not over the --

23 MR. HANLEY: Oh, certainly. We have a  
24 computer program that warns us if we get within five  
25 megawatts thermal of our rated thermal power. So the

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1 operators -- it runs on a -- every two minutes. So  
2 they will --

3 CHAIRMAN WALLIS: So it is definitely an  
4 upper bound. I mean, it is almost the impression that  
5 is being given that with the line through that orange  
6 jiggling around that you can jiggle around some set  
7 point or something. But actually the 2957, that is an  
8 upper bound isn't it?

9 MR. HANLEY: Well, if you draw crosses,  
10 and the top of the crosses are all very much the same  
11 place. So the actual data goes --

12 CHAIRMAN WALLIS: But the top of the  
13 crosses would be the 2957 if you ever get there.

14 MR. HANLEY: The middle of the cross.

15 MR. HAEGER: The middle of the cross.

16 CHAIRMAN WALLIS: The middle of the cross?

17 MR. POST: This is just a plot in XL.

18 MR. HANLEY: XL uses the point to put a  
19 cross at --

20 CHAIRMAN WALLIS: Okay. So it is not the  
21 line that is jiggling around. All right. Okay.

22 MR. HANLEY: Are there any other  
23 questions? With that, I will turn it back over to  
24 John Freeman and Jason to discuss ATWS.

25 MR. FREEMAN: Thanks, Tim. We are going

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1 to talk about anticipated transient without SCRAM, and  
2 Jason is going to go over some of the methodology and  
3 assumptions.

4 CHAIRMAN WALLIS: I guess if you are using  
5 established methodology and assumptions we can skip to  
6 the results.

7 MR. FREEMAN: Surely.

8 MR. POST: That would be great. We did  
9 have one slide in here on ATWS instability, or  
10 actually two slides that I am prepared to cover. As  
11 we discussed previously when I was here for Duane  
12 Arnold, the two reports were NEDO-32047, which was the  
13 instability with no mitigation; and the 32164, had the  
14 instability with mitigation.

15 And our previous argument was that these  
16 generic studies were applicable to EPU and MELLLLA, and  
17 there was some question about that. We since our last  
18 meeting, we have done a sensitivity study at a more  
19 limiting condition.

20 It is on a rod line actually above the  
21 MELLLLA line. It is for an EPU condition, and it is  
22 for G.E. 14, and we have finished the no mitigation  
23 study, and it showed a less severe fuel response than  
24 we showed previously in the topical report with no  
25 mitigation.

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1           In other words, it had less susceptibility  
2           to the extended dryout. It still could experience the  
3           extended dryout, but it took a little bit longer time  
4           to get the oscillation that put it into that  
5           condition.

6           So this confirms our expectation that the  
7           generic studies are valid for EPU and MELLLA, and  
8           confirms our expectation that the mitigation actions  
9           will be effective.

10           MR. FREEMAN: Okay. I would like to skip  
11           forward to page 47. These are the results for the  
12           five criteria and the limiting event. You can see  
13           over here the peak pressure of 1492 was below the  
14           acceptance criteria of 1500.

15           For the peak pool temperature, 201 was  
16           below this 202 degrees, which I think Mark may have  
17           mentioned was the TORUS attached piping limit that was  
18           analyzed for the LOCA.

19           It turns out -- and you probably remember  
20           that 281 was a structural limit for the suppression  
21           pool. But these results show that they are quite  
22           acceptable.

23           CHAIRMAN WALLIS: So you are again pushing  
24           the limit on pressure and temperature, the 1499 versus  
25           the 1500?

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1 MR. FREEMAN: This 1499 is for transition  
2 core, and that included -- all these analyses were  
3 done with exactly the same inputs, and they have  
4 conservatisms built in.

5 So we would actually expect not to see a  
6 pressure like this. That is a conservative number.

7 CHAIRMAN WALLIS: But in terms of the  
8 criteria, you are just meeting the criteria.

9 MR. FREEMAN: Yes, sir. Of course, with  
10 the peak suppression pool temperature, it is very low,  
11 and the peak clad temperature is also very low, which  
12 has a negligible maximum local oxidation.

13 So in every case for ATWS, which is a  
14 beyond design basis event, this demonstrates that the  
15 50.62 criteria can be met.

16 CHAIRMAN WALLIS: Doesn't this depend on  
17 valves opening and that sort of thing, and numbers of  
18 valves?

19 MR. FREEMAN: Yes.

20 CHAIRMAN WALLIS: And do you have to have  
21 more valves open in this case than before, or is that  
22 a different --

23 DR. SIEBER: It depends on the success  
24 criteria.

25 MR. FREEMAN: The ATWS analysis takes

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1 credit for all the relief and safety valves as is  
2 typical for ATWS analysis.

3 MR. HAEGER: However, in the PRA study, we  
4 will be discussing --

5 CHAIRMAN WALLIS: Yes, you need one more  
6 valve to show the open.

7 MR. HAEGER: That's correct, and we will  
8 be talking about that.

9 MR. FREEMAN: Okay. With that, I would  
10 like to introduce Norm Hanley, and he is going to talk  
11 about the piping analysis.

12 CHAIRMAN WALLIS: With the ATWS, there is  
13 no requirement about operator reaction time in any of  
14 the ATWS regulations? It only appears in the PRA?  
15 There is nothing in the --

16 MR. POST: That's right. There is nothing  
17 in the regulation that specifies what the minimum or  
18 maximum operator action time is.

19 MR. N. HANLEY: Good afternoon. I am Norm  
20 Hanley, and I am the test manager for the piping  
21 evaluations that were performed for the power uprate  
22 for Quads and Dresden City.

23 I am going to present the methodology that  
24 was used to do the piping evaluation, and the actual  
25 impacts as a result of the EPU, and what the

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1 disposition and conclusion, and results of those  
2 evaluations that were performed.

3 The impact of the power uprate would be a  
4 change in the operating conditions, flow pressure and  
5 temperature in some of the fluid systems. In order to  
6 evaluate those systems, we reviewed the plant specific  
7 criteria to identify those parameter bases for the  
8 existing analysis.

9 We also as part of that review identified  
10 what the original code that was used, the analytical  
11 techniques that are used consistent with the license  
12 spaces, and also the code allowables.

13 The one exception to this was that we  
14 developed some criteria for the main steam piping  
15 consideration for dynamic loads due to a turbine stop  
16 valve, and I will address that in my presentation.

17 The conclusion in the initial review was  
18 that the majority of the piping systems were not  
19 impacted by the power uprate. The methodology that  
20 was employed to evaluate those systems that were  
21 impacted was a simple evaluation to identify what we  
22 call a change factor.

23 This looked at those parameters such as,  
24 for instance, in temperature, and if the temperature  
25 changed or the operating temperature would be higher

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1 for a power uprate, we simply looked at that delta  
2 change and compared it to the original analysis basis.

3 And if the comparison was the post-uprate  
4 versus pre-uprate was greater than 1.0 the ratio, then  
5 we would evaluate it further. Any ratio less than  
6 1.0, the pre-uprate conditions were bounding, and no  
7 further analysis was required. For minor changes in  
8 the parameter --

9 CHAIRMAN WALLIS: There didn't go for  
10 pressure or anything like that. This didn't go for  
11 vessel pressure? This is just piping?

12 MR. N. HANLEY: This is piping, correct.  
13 Now, for minor changes, where the parameter change was  
14 between 1.0 and 1.05, again we considered the change  
15 acceptable.

16 And this is based on a conservatism in the  
17 original analysis, and some of these conservatisms  
18 where the initial inputs were conservative, the  
19 combination of loads, and incorporating loads that had  
20 been changed for the power uprates for seismic and  
21 dead weight, and also due to the inherent analytical  
22 techniques where there were gaps between piping and  
23 pipe supports were not included.

24 DR. SIEBER: Could I interpret this to say  
25 that if it was less than 5 percent, you didn't bother

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1 to find out where the conservatisms were, or whether  
2 it was conservative or not? You just said it was  
3 okay?

4 MR. N. HANLEY: Right. And that was based  
5 on experience with the piping systems and evaluations  
6 that we performed. We have done a number of power  
7 uprates where we have used this application.

8 MR. HAEGER: Realize that we are taking  
9 one parameter and if it changed five percent, there  
10 are all the other factors in the equation that we are  
11 seeing, there is conservatisms in there. So that is  
12 the basis of that.

13 MR. N. HANLEY: I think when I present the  
14 systems that were impacted and where we did further  
15 evaluations, we will see what -- I think we can  
16 support some of that argument there.

17 Where the change factors were greater than  
18 1.05, we did take the next step, which was to look at  
19 that ratio. Let's say, for instance, the ratio is  
20 1.1, and we would take that parameter and scale the  
21 existing peak load up, and see if it was within the  
22 acceptance criteria of the code allowables.

23 And gain if it was less than the code  
24 allowable acceptance criteria, the analysis was  
25 acceptable. Now, for cases where we couldn't do that,

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1 we did go back and reevaluate or reanalyze the piping  
2 system, and if needed we would do modifications.

3 The most notable change area was the  
4 temperature change due to the TORUS border temperature  
5 increase. The increase was approximately about a 20  
6 degree temperature change for the pre-uprate and the  
7 post-uprate.

8 We did have to do reanalysis and  
9 modification for this system. However, the  
10 modifications were isolated primarily to piping  
11 supports, and in existing supports, we didn't have to  
12 add new supports.

13 Those changes resulted in like the  
14 replacing of U-bolts, the modification of the base  
15 plates, structural members, et cetera. The most  
16 noticeable change was that we did have to replace the  
17 rigid support with a snubber to reduce the piping  
18 loads on the flange connection.

19 So I think that type of analysis, rigorous  
20 analysis that we did there, a significant change  
21 resulted in that.

22 CHAIRMAN WALLIS: Were there any changes  
23 that ACRS needs to worry about? I mean, changing  
24 bolts and snubbers --

25 MR. N. HANLEY: These were minor

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1 components to the existing supports, and just to show  
2 that their load capacity could be handled. The other  
3 significant change that we had was the main steam  
4 piping, where we incorporated the dynamic loads due to  
5 a turbine stop valve closure event.

6 The original design for Quads and Dresden  
7 is based on static load conditions outside  
8 containment, and a dynamic load condition inside  
9 containment for a safety relief valve-load. It did  
10 not include the turbine stop valve loads.

11 We evaluated the impact of the uprate on  
12 a turbine stop valve closure event, and since we do  
13 increase flow approximately 20 percent, we felt that  
14 it would be prudent for us to include the impact of  
15 that turbine stop valve closure event.

16 The evaluation identified that there was  
17 significant impact on the loading on the piping system  
18 outside containment, as well as the piping supports  
19 and drywell steel on the inside of the containment.  
20 The resulting evaluations required modifications.

21 CHAIRMAN WALLIS: That's because the  
22 closure is rapid; is that it?

23 MR. N. HANLEY: Yes, you have a very rapid  
24 hundred milliseconds or what it is, and so you have a  
25 significant on the change. So the approach that we

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1 took to the evaluation of that was that we wanted to  
2 make sure that for a turbine stop valve closure event  
3 itself that we didn't have a defamiation of the piping  
4 system.

5 And also we looked at it coupled with a  
6 seismic, and we wanted to maintain structural  
7 integrity with a seismic event resulting from a  
8 turbine stop valve closure.

9 So the approach that we used was there  
10 would be no loss of structural integrity coupled with  
11 a seismic event.

12 DR. SIEBER: Well, you probably had a  
13 number of stop valve closure events in the history of  
14 these two units.

15 MR. N. HANLEY: Correct.

16 DR. SIEBER: Did you get damage?

17 MR. HAEGER: We have never seen damage.

18 CHAIRMAN WALLIS: Well, damage in terms of  
19 broken snubbers is a pretty minor thing compared with  
20 a safety --

21 MR. D. HANLEY: Right. There was no  
22 identified or reported when we did the evaluations.  
23 And again the piping system itself is -- that when we  
24 evaluated it and used conservative assumptions, then  
25 you would see the overload on the existing snubbers

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1 and supports.

2 So the result was that for the piping  
3 inside containment, the changes to the existing  
4 snubbers, we replaced some with higher capacity. We  
5 had to replace some members with higher members.

6 We also had to evaluate the drywell steel  
7 which was supporting -- taking a load from the  
8 supports. There we had to stiffen up the connections  
9 to take the increased load capacity.

10 The more significant changes were outside  
11 the containment, where the piping as I mentioned  
12 earlier was a static load design. We did have to add  
13 supports to take the lateral loads.

14 The main supports were -- well, we put in  
15 specially designed clamps with a box frame support at  
16 the main steam header to take the load, and we also  
17 had some lateral guides through the G-line wall at  
18 Dresden.

19 Quad Cities is similar, and we added some  
20 supports on the main steam lines, and these were more  
21 towards the main steam isolation valve in the tunnel.  
22 Again, we used the specially designed clamps with  
23 vertical and horizontal struts.

24 DR. SIEBER: You would have had to do that  
25 whether you were doing an uprate or not, right?

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1 MR. HAEGER: As he said, they were not  
2 designed, originally designed for these dynamic loads.

3  
4 DR. SIEBER: But they should have been,  
5 right? I guess in '68, which is the code of record,  
6 it was not in the code of record?

7 MR. HAEGER: That's correct.

8 CHAIRMAN WALLIS: Okay. Go to your  
9 conclusion.

10 MR. N. HANLEY: Yes. The conclusion is  
11 that the piping analysis demonstrated that the piping  
12 will meet acceptable requirements based on the --  
13 consistent with the current licensing design basis.

14 CHAIRMAN WALLIS: But you have made them  
15 acceptable.

16 MR. N. HANLEY: We made them acceptable by  
17 doing modifications in the TORUS attached piping area,  
18 and also we incorporated the TSV loads, and made those  
19 analyses acceptable as well.

20 So the conclusion is that with the  
21 modifications and the reanalysis the piping systems  
22 will be adequate for an extended power uprate.

23 CHAIRMAN WALLIS: I am inclined to think  
24 that we should go to this next one, reactor and  
25 internals, and perhaps take a break after that.

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1 MR. N. HANLEY: Actually, the next two fit  
2 real nicely together, and the second one can be short,  
3 but either way.

4 CHAIRMAN WALLIS: Well, let's see how we  
5 do. We are getting pretty close to the time where we  
6 are going to need a break. So, let's go ahead with  
7 reactor and internals.

8 MR. N. HANLEY: I would like to introduce  
9 Keith Moser now to discuss reactor and internals.  
10 Thank you.

11 MR. MOSER: Hello. My name is Keith  
12 Moser, and I am the reactor and internals program  
13 manager for Exelon, and I want I want to cover today  
14 is the scope and methods that we used to evaluate  
15 reactor and internals for power uprate conditions.

16 And the effect that EPU had on those  
17 components, and the modifications that John Nosko  
18 talked about earlier. And then finally conclusions.

19 Before we even started the power uprate  
20 project, Exelon and G.E. had developed an asset  
21 management strategy that took into account the  
22 industry information both from the domestic fleet and  
23 G.E.'s worldwide experience, and compared that against  
24 what we had done in our inspection program and  
25 operating history at Dresden and Quad.

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1           And we came up with susceptibility  
2 rankings for each one of our components, and at that  
3 point what we did is that we came up with inspection  
4 strategies, mitigation strategies, and finally repair  
5 strategies if we needed them.

6           Now, for EPU, we again went component by  
7 component and one of the first ones that I wanted to  
8 go over was the fluence issue that was just talked  
9 about earlier.

10           Now, back in 1992 -- and, John, if you  
11 don't mind holding that up. Back in 1992, we wanted  
12 to take advantage of two co-case. The first one was  
13 co-case 640, and the next one was co-case 580.

14           And especially for Quad Cities and  
15 Dresden, it lowered our temperature at which we did  
16 hydro tests from about the 212 range by 50 degrees to  
17 55 degrees.

18           And in doing this, we went back and looked  
19 at what fluence calculation was done in the past. The  
20 fluence calculation of record was for the Southwest  
21 Research, and what they had done is that they had  
22 actually taken capsule pools from all four units and  
23 the capsule pools ranged after they scaled them up  
24 from 3.5 times 10 to the 17th neutrons per centimeter  
25 squared, all the way up to 5.1 times 10 to the 17th

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1 neutrons per centimeter squared.

2 In our evaluations, we took the most  
3 bounding and said this is where we are going to do our  
4 fluence calculations for the 1999 and 2000 PT curves.

5 What we have come to find out after we  
6 have done the neutron transport calculation for power  
7 uprate is the following. Yes, we are lower than what  
8 was previously put into the PT curves that was done by  
9 Southwest Research, but we have an explanation of why.

10 And I just got that from my expert, Gida  
11 Boo, and Sam Ranganath, and Brian Frue, and Betty  
12 Bramlin at G.E., and what we think has happened is  
13 when they modeled their capsule with their fluence  
14 methodology, they had it right up against the reactor  
15 wall.

16 They did not take into account about a  
17 little over one inch gap and that difference is where  
18 we think a lot of this can be explained. We also  
19 understand that the methodology at that point in time  
20 didn't require you to model the jet pump in the -- I'm  
21 sorry, the fast flux calculation.

22 Those type of things make it not an apples  
23 to apples comparison. Now, there are improvements in  
24 the methodology, and we are following the new NRC  
25 requirements, but we honestly think it is the spacing

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1 that they did not take into account for the capsule  
2 itself.

3 CHAIRMAN WALLIS: Now, tell me more about  
4 this. The capsule, it is an experiment? They put  
5 something in there?

6 MR. MOSER: That is a sample capsule that  
7 he put right in the belt line region.

8 CHAIRMAN WALLIS: So it is an experiment.  
9 You put something in.

10 MR. MOSER: It is on a bracket that is  
11 held away from the vessel walk and the distance like  
12 I was saying is a little bit over an inch. And if you  
13 don't model that, even though it is not that far, just  
14 the attenuation through that one inch gap, or 1.75  
15 inch gap, is enough to make a significant difference.

16 MR. HAEGER: Let me make sure that we have  
17 the right perspective on this. When we applied for  
18 the EPU application, we used the G.E. improved fluence  
19 methodology that Keith is describing now. That  
20 calculation showed that our fluence is actually lower  
21 than what we had projected.

22 DR. SIEBER: So the bottom line is that  
23 you made out, right?

24 MR. HAEGER: Right, although -- well, let  
25 me finish though. At the time that we had our

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1 application in, that methodology was being reviewed by  
2 the NRC staff and had not yet been accepted.

3 CHAIRMAN WALLIS: But it has now been  
4 accepted?

5 MR. HAEGER: It has now been accepted, but  
6 there are some data that G.E. needs to collect over  
7 the next couple of years to do some verifications.

8 CHAIRMAN WALLIS: So is it true then that  
9 the actual fluence has probably gone up, but the  
10 calculated fluence has gone down?

11 MR. HAEGER: That's correct.

12 MR. MOSER: As you would expect.

13 MR. HAEGER: That's correct. But to put  
14 the final note on this, currently we are only asking  
15 the staff to approve our application for one cycle of  
16 operation with the current PT curves until this issue  
17 is further wrung out.

18 CHAIRMAN WALLIS: Will there be some  
19 future better measurements of fluence that we can rely  
20 on, rather than just calculation?

21 MR. MOSER: Actually, when G.E. did their  
22 methodology, they actually had samples from KKM that  
23 they had pulled, along with the overall sample program  
24 for the industry.

25 The sample population for BWRs isn't quite

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1 as big as it is for a PWR. As we go in time and we  
2 have more capsules that are being pulled, additional  
3 fluence calculations will be done, and we will make  
4 sure that the methodology is correct.

5 MR. BOEHNERT: Do you have samples at the  
6 Dresden and Quad Cities?

7 MR. MOSER: We have samples at Dresden and  
8 Quad Cities, but they are part of the integrated  
9 surveillance program that the BWRVIP is in the process  
10 of pursuing.

11 DR. SIEBER: And if you had an extended  
12 life license you would not have enough samples to take  
13 you to the end, right?

14 MR. MOSER: Say that again, sir?

15 DR. SIEBER: If you went for a 60 year  
16 license term, you wouldn't have enough samples.

17 MR. MOSER: Well, as an industry, we will  
18 have enough samples, but if we --

19 DR. SIEBER: You have to use the new  
20 dosimetry methods and you will be okay.

21 MR. MOSER: Yes.

22 DR. FORD: How much will the flux  
23 increase?

24 MR. MOSER: You know, I had Harmeta look  
25 into that for me a whole back, and the nice thing

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1 about Dresden and Quad, because they have got such a  
2 big vessel -- it is a 251 inch vessel, and my power  
3 out of the core is so much lower than a BWR-4 or a  
4 BWR-5, and a BWR-6 of the same size.

5 At this point in life, I am still below 5  
6 times 10 to the 20th neutrons per centimeters squared  
7 at the eight-four. Now, we have the shroud repairs  
8 already in place, but it is nice when I inspect my  
9 vertical welds on the shroud.

10 DR. FORD: How much will be the flux be?

11 DR. SIEBER: Seventeen percent.

12 MR. MOSER: It is about 17 percent, but  
13 that is based on actually being somewhat lower than  
14 what we had projected with the Southwest Research  
15 methodology.

16 DR. FORD: Is it more than 17 percent  
17 because you are flattening the --

18 MR. MOSER: It will be somewhat less than  
19 that.

20 DR. SIEBER: Well, you don't run it at a  
21 hundred percent all the time either.

22 MR. HAEGER: Well, I guess the point is  
23 that we didn't do an apples to apples comparison pre-  
24 to-post EPU. We used the new fluence methodology that  
25 showed the decrease in the overall fluence, and not

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1 having done that apples to apples comparison, I don't  
2 think we can tell you.

3 The point is that it appears to have gone  
4 down from our previous count.

5 CHAIRMAN WALLIS: And what is the core  
6 shroud --

7 MR. MOSER: Actually, we have done Noble  
8 Chem, and so that projects the inside and the outside  
9 surface, and we have also done the shroud repair tie  
10 rods at all four units.

11 And again that takes care of all of the  
12 horizontal welds. So the inspection plan would be the  
13 vertical welds, which we are doing on a good basis.

14 CHAIRMAN WALLIS: I would guess that at  
15 the time of license renewal application that all of  
16 this is going to be revisited?

17 MR. MOSER: I am sure it will be.

18 MR. HAEGER: Yes.

19 MR. MOSER: You know, going on, the other  
20 areas that I wanted to discuss were related to flow  
21 induced vibration, and there is two issues; the  
22 increase in steam flow, and the increase in the dry  
23 flow. If you would switch to the next slide. The  
24 Dresden-2 --

25 DR. FORD: Hold on. How much will the

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1 delta-P increase -- well, the --

2 MR. MOSER: I just read that, and I don't  
3 have that on the tip of my tongue, but we can look  
4 that up and give it back to you. It is not a very  
5 large increase from what I remember.

6 DR. FORD: So in the risk assessment, and  
7 not the PRA type assessment, but the numerical  
8 assessment, was there taken into account any potential  
9 cracking of the excess hole covers?

10 MR. MOSER: You know, for three out of our  
11 four units, we have actually replaced the access hoe  
12 cover, and so that risk somewhat goes away. And then  
13 we with the Noble Chem application, and the hydrogen  
14 injection that we are doing, we feel like we have an  
15 adequate basis for mitigating the shroud excess hole  
16 covers.

17 And for the one unit that we haven't  
18 replaced, we do inspections on a periodic basis per  
19 the SIL (phonetic) and the VIP, and while we are down  
20 there looking at the shroud support, we also look at  
21 the access hole cover. Did that answer your question?

22 CHAIRMAN WALLIS: Noble Chem is good.

23 MR. MOSER: Say that again?

24 CHAIRMAN WALLIS: Noble Chem is good.

25 MR. MOSER: Yes, I really like that

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1 benefit. Again, for the dry flow, we had the benefit  
2 at Dresden of actually being the first BWR-3 plant,  
3 and so it was well instrumented across all the reactor  
4 or many of the reactor internals component.

5 And that included the jet pump and the  
6 steam separator. When they did the power uprate, they  
7 varied the levels of power, and they did single loop  
8 and double-loop operations, and then they were able to  
9 extrapolate that information as we went to power  
10 uprate conditions.

11 The analytical result of that work was  
12 that accept for the eight jet pump sensing lines, I  
13 really have no material endurance conditions that I am  
14 worried about for the components that I have analyzed.

15 Now, for the eight jet pump sensing lines,  
16 we are slightly increasing our RPM pumps leak speed by  
17 about 25 to 27 RPM. And we are so close. One thing  
18 that is somewhat unique about Dresden and Quad is we  
19 have six vain and pillar rather than a five vain and  
20 pillar at Peach Bottom and Limerick.

21 And when you do that, and just have a  
22 slight increase, you have eight jet pump sensing lines  
23 that are close to the natural frequency of the vain  
24 passing frequency.

25 We had two options. We could go down

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1 there and do a ring test on these eight welds, or  
2 eight jet pump sensing lines. But the time that it  
3 took and the benefit of only being able to exclude  
4 maybe one or two of these, we decided to preemptively  
5 strike and install the clamp on all HF pump sensing  
6 lines, and in fact we will be doing that tomorrow at  
7 Dresden.

8 The dryer posed a different problem, and  
9 that is a steam flow problem, and just last year at  
10 Quad Cities when we were in our fall outage, we found  
11 higher than anticipated radiological issues on our  
12 secondary side.

13 And as a result of that, we immediately  
14 went into a route cause analysis, and my job was to  
15 investigate the dryer and the separators and see if  
16 there was enough degradation that would cause that  
17 moisture carryover to occur.

18 We put a camera on every square inch that  
19 we could get to with either a robot or a sub, and  
20 after we looked at this, we really had no degradation  
21 that would explain the moisture carryover.

22 In fact, they were in fairly pristine  
23 condition. So in a sense what happened is that we  
24 focused our route cause -- and if you will move on to  
25 the next slide, we focused our route cause on the core

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1 loading and how we operated the core.

2 And we found that there is some  
3 differentials in pressure as you get hot areas. And  
4 the steaming effect -- and this isn't the best  
5 picture, but essentially it would overcome the dryer  
6 in a certain location, and the dryer, because it  
7 didn't have a perforated plate, wasn't able to  
8 essentially have the flow dissipate across the dryer  
9 bank to make full utilization of the dryer.

10 So what we did is we used our Moss Landing  
11 test data that we had when we were originally  
12 designing these dryers, and we used computational  
13 fluid dynamics, and came up with a perforated plate,  
14 and pulled or looked at each one all the way across  
15 this.

16 And what that does is essentially flattens  
17 out the steam flow across the dryer bank and decrease  
18 the velocity going through the dryer so that it is  
19 able to perform its function.

20 CHAIRMAN WALLIS: And all of this has  
21 already been installed?

22 MR. MOSER: It is being installed as we  
23 speak. In fact, I need to go back and see how the  
24 progress is doing.

25 CHAIRMAN WALLIS: So we don't know yet if

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1 it works?

2 MR. MOSER: We will know in a couple --  
3 about a week or two.

4 CHAIRMAN WALLIS: Now, we had the Duane  
5 Arnold presentation a couple of weeks ago, and they  
6 talked about the increase in frequency of loading  
7 vibration in the steam dryer, and that being  
8 transferred to the brackets on the steam dryer. How  
9 are we set for this one?

10 MR. MOSER: Actually, again, since we are  
11 installing the dryer modification, we do stiffen up  
12 the whole dryer assembly, but the Dresden and Quad  
13 dryers, because they were somewhat smaller and thicker  
14 than the models that preceded it, we have a much  
15 stiffer unit than say a Peach Bottom unit would be.

16 Now, we also -- if you will flip to the  
17 next slide, we wanted to cover that. You know, based  
18 on what we have done with our asset management, we do  
19 know that flow induced vibration is a concern.

20 And even though we modeled everything with  
21 a ANSI finite element program, 3-dimensional, and we  
22 made sure that both the dryer and the modification  
23 were well below their endurance limits, and there were  
24 no problems from that aspect, we know that modeling  
25 isn't always a perfect science.

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1           And so what we have done is we have gone  
2 to the place to say what can we do from an asset  
3 management strategy, and what are the safety concerns.  
4 Can we address this by just going in and doing an  
5 inspection plan.

6           And one of the things that I want John to  
7 hold up -- and this isn't quite a BWR-3 unfortunately,  
8 but if you look at this dryer up here, we anticipate  
9 that you will get a fairly good sized chunk out of  
10 that if it actually cracked off.

11           And the places for it to go are really  
12 down, and so you get on top of the shroud head, and  
13 you may get down on the annulus, but it is almost  
14 impossible -- well, it is impossible in our estimation  
15 to get it into the fuel where you are really going to  
16 cause some damage.

17           The other thing that G.E. did for us is  
18 that in the unlikely case that we actually got part of  
19 the dryer to go out and get out to an MSIV line, they  
20 looked at what the MSIV closure would be, and came to  
21 the conclusion that it would not be an issue and that  
22 we would be able to close our MSIVs.

23           DR. FORD:     The steam dryer support  
24 bracket, have you had experience with those cracking  
25 at Dresden or Quad Cities?

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1 MR. MOSER: I have not had any experience  
2 with that at Dresden or Quad, but we do understand the  
3 Susquehanna event and we do understand that there is  
4 an Asian plant that just had an experience with that.

5 DR. FORD: Because it could potentially  
6 crack and you would have the whole dryer assemblies.

7 MR. MOSER: Well, one of the things that  
8 we do is we inspect those on a very periodic basis,  
9 and so far we have not had that problem, but we do  
10 understand that it is a potential issue, and when we  
11 set this, we will make sure that we don't have the  
12 rocking concerning that Susquehanna had. Any other  
13 questions?

14 DR. SCHROCK: You mentioned the Moss  
15 Landing data. That is an experiment that was done on  
16 a partial mock-up?

17 MR. MOSER: If I remember right, it was a  
18 full-scale mockup.

19 DR. SCHROCK: A full-scale?

20 MR. MOSER: Yes. This was back in time  
21 where Moss Landing --

22 MR. HAEGER: George is shaking his head  
23 no.

24 DR. SCHROCK: I didn't think it was.

25 MR. MOSER: Partial? Forgive me, partial.

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1 Any other questions?

2 MR. HAEGER: Do you want to move on?

3 CHAIRMAN WALLIS: Well, I guess we should  
4 probably take a break. I am just thinking that it  
5 would be more reassuring to me if you had some sort of  
6 quantitative measure of success here, and you could  
7 show that on that scale the present system and the EPU  
8 were fitted somewhere so that we knew where we were,  
9 in terms of getting to some --

10 MR. MOSER: On the carry over?

11 CHAIRMAN WALLIS: Well, you had a  
12 discussion here about --

13 MR. HAEGER: I should point out that each  
14 of the reactor internal components was formally  
15 evaluated for stresses, and that those were all within  
16 acceptance.

17 CHAIRMAN WALLIS: And again it would be  
18 useful if you could show that you have made -- that it  
19 appears in the previous case there was criteria for  
20 acceptance, and here is the new case, and here is some  
21 criteria for acceptance, and see some numbers or  
22 matrix of comparisons.

23 It would be a little bit more reassuring  
24 to me than a discursive presentation.

25 MR. MOSER: Actually, we have a backup

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1 slide. We did testing at the Peerless facility in  
2 Dallas to make sure that our perforated plate was  
3 going to work, and if you don't mind putting that up.

4 It is a two-pronged approach. We have to  
5 manage the core correctly, and we can't have a very  
6 hot spot.

7 MR. HAEGER: Are you talking about this  
8 one, Keith?

9 MR. MOSER: Yes.

10 MR. HAEGER: I think he is thinking though  
11 about -- you are thinking about the stresses?

12 CHAIRMAN WALLIS: Yes.

13 MR. HAEGER: And that is all in the  
14 material that we submitted to the NRC. I guess -- I  
15 apologize --

16 CHAIRMAN WALLIS: So we have to ask the  
17 staff about how they found this material acceptable,  
18 rather than see the material itself?

19 MR. MOSER: The actual stress loads on the  
20 dryer are very, very low from the analytical  
21 standpoint. They are well below 10,000.

22 CHAIRMAN WALLIS: As long as it doesn't  
23 vibrate?

24 MR. MOSER: Yes, as long as it doesn't  
25 vibrate.

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1 MR. HAEGER: And just to summarize what  
2 Keith said, we did the finite element modeling on the  
3 dryer, and that showed that within limits, and then we  
4 are following that up with the inspection program.

5 CHAIRMAN WALLIS: And you are doing that  
6 because the actual prediction of these vibrations is  
7 a little bit iffy, and so you have to keep monitoring  
8 and inspecting.

9 MR. MOSER: You know, going back to our  
10 asset management strategy, if there is industry  
11 experience, we want to keep on top of it, and that is  
12 why we have the inspection program.

13 CHAIRMAN WALLIS: I think this might be a  
14 good time to take a break. Can we be back by 3:30?  
15 We will take a break until 3:30.

16 (Whereupon, at 3:19 p.m., the meeting was  
17 recessed and resumed at 3:31 p.m.)

18 CHAIRMAN WALLIS: Back on the record.

19 MR. CROCKETT: Good afternoon. I am  
20 Harold Crockett, and I am the fact program manager  
21 with Exelon and Canterra. I would like to talk about  
22 our flow accelerated corrosion program this afternoon,  
23 and from time to time I will change that name to the  
24 acronym FAC.

25 What have we done to address uprates. I

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1 am going to talk a little bit about susceptibility.  
2 It is interesting to note that there are no new  
3 systems susceptible to FAC as a result of the uprate.

4 And I am going to talk about the  
5 predictive methodology and the CHECWORKS analysis, and  
6 then we will go into the impact in a following slide,  
7 and show some of the details of that.

8 I will discuss our programmatic controls,  
9 and how our program works, and how do we do these  
10 things. And then I will summarize on a conclusion  
11 slide.

12 It is useful to start with susceptibility.  
13 This is a chemical degradation, and fact effects,  
14 carbon steel components in a steam cycle, where the  
15 temperature exceeds 200 degrees fahrenheit --

16 DR. KRESS: Do you add oxygen into your  
17 system?

18 MR. CROCKETT: Yes, sir. Dissolved oxygen  
19 is typically I think 30 ppb or greater typically.  
20 Dresden and Quad Cities use the standardized Exelon  
21 programs to predict, detect, and monitor for full  
22 accelerated corrosion.

23 And we use the EPRI guidelines that is  
24 really the basis for all domestic power plants, the  
25 ANSAC-202L document, and that is really a living

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1 document that is revised from time to time, and it has  
2 caused us to realize other activities at the plant  
3 that tie into our FAC program, notably our performance  
4 monitoring leaking valves, and those kinds of things  
5 that we turn into our program.

6 We go in and examine now some of the  
7 components, and the feed water heater shells have been  
8 a big issue in the past several years. So staying in  
9 touch as far as the industry has helped us a lot.

10 The code that we use for our predictive  
11 analysis is the EPRI CHECWORKS code, and that is how  
12 we evaluated our changes, and that's how we initially  
13 modeled the plant.

14 And then in the next slide, I will  
15 describe the EPU conditions and how they are bounded  
16 by the CHECWORKS parameter ranges. This slide  
17 addresses the changed input for the analysis.

18 Obviously, there are other inputs -- the  
19 typing diameter, and piping material, and geometry  
20 factors, that did not change. But here are some of  
21 them that were, and while I was preparing this slide,  
22 I called up some of my counterparts at the other  
23 utilities just to get a feel for what kind of values  
24 they were using in their plants.

25 Are we are hitting new ranges that we have

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1 not previously seen in the industry, and that was kind  
2 of my question, and I wanted to find out where they  
3 were.

4 So I am going to talk about four of these  
5 values right now; the steam rate, or really for the  
6 sake of this discussion the feed rate, and these  
7 numbers will vary because obviously you have seen some  
8 other charts that may talk about valves wide open,  
9 versus hundred percent power, and 115 percent power,  
10 and those kinds of issues.

11 But the numbers will be consistent in our  
12 analysis. The CHECWORKS program is really geared up  
13 to have a hundred-million pounds per hour, and  
14 obviously nobody is at that level.

15 The pre-uprate, we were at about 9-1/2  
16 million pounds per hour, and we will be going to a  
17 little over 11-1/2 million pounds per hour. Now,  
18 BWRs, the ones that I talked to were as high at 14  
19 million pounds per hour, and PWRs almost approaching  
20 16 million pounds per hour.

21 Now, the velocity, obviously since your  
22 diameters change throughout the line in going through  
23 valves and such, and it is calculated in the program,  
24 and feedwater is pretty significant to people  
25 obviously.

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1                   Our old analysis, I think actually this  
2 philosophy was before the feed pumps, where we found  
3 22 feet per second. With the new analysis, and with  
4 all the pumps going, we actually -- the highest value  
5 that I found was just over 23 feet per second.

6                   And when I was talking to some of the  
7 other utilities, the numbers that I got feedback on  
8 were 24 feet per second and higher, and after I made  
9 up this slide, I talked to one that mentioned 27 feet  
10 per second, and these are not updated conditions.

11                   And so we are still within those values as  
12 well. Steam quality. We have talked a little bit  
13 about how we are maintaining the dryness of the steam,  
14 and the operating temperature, and some slight  
15 differences there.

16                   We are going in the final feed water from  
17 340 degrees to 356. Boiling water reactors we have  
18 seen 420 degrees, and PWRs, 446 degrees. And actually  
19 check codes have been used on fossil plants to  
20 slightly higher temperatures.

21                   So the conclusion is that all of our  
22 values are really within where the industry is using  
23 the predictive analysis.

24                   DR. SIEBER: A quick question on steam  
25 quality, do you have a way to measure it in your

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1 plant?

2 MR. HAEGER: Yes, we will do a carry over  
3 test with the steam dryers. At Braidwood, for  
4 instance, we did it with saviors.

5 DR. SIEBER: Well, you can't do that with  
6 BWR. It gets swamped out.

7 MR. DIETZ: My name is Jerry Dietz, and I  
8 put together the start up tests. We will be measuring  
9 the carryover with sodium from the reactor. It is  
10 trans-sodium that is naturally occurring, and it will  
11 take a sample in the hotwell and in the bottom of the  
12 condenser, and we will compare the two, and that ratio  
13 will give us the carry over.

14 DR. SIEBER: Do you do that on a regular  
15 basis or just as a part of the start up?

16 MR. DIETZ: Well, we have been doing it  
17 for almost a year now at the plants in regards to our  
18 modification, and then we will be doing it as we come  
19 up at each pipe toe in the test, verifying that it is  
20 correct.

21 There has been some new industry data,  
22 too, that there is some assumed values for carryover  
23 and some plants have much lower, and we are also  
24 factoring that into our test program.

25 DR. SIEBER: It seems to me that unless

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1 you measure them on a periodic basis, degradation of  
2 the dryer elements would cause additional moisture,  
3 which accelerates flow, which accelerates corrosion.

4 MR. DIETZ: It will change with each set  
5 of rod patterns, and configuration of rods, and Tim  
6 may be able to tell us more about what Quad does.

7 MR. HANLEY: Several years ago -- this is  
8 Tim Hanley again. Several years ago, we found that we  
9 had a carryover issue at Quads City, Unit 1, and to  
10 monitor that and address this, we do on a periodic  
11 basis take samples in the hotwell and determine our  
12 carryover fraction.

13 I can't say for sure that they do that at  
14 Dresden, but I do know that we do that at Quad Cities  
15 as part of a routine chemistry sample.

16 DR. SIEBER: And routine is what, monthly  
17 or something like that?

18 MR. HANLEY: Yes, I believe it is done on  
19 a monthly basis.

20 DR. SIEBER: Thank you.

21 CHAIRMAN WALLIS: So your concern is  
22 corrosion in the steam line; is that what you are  
23 worried about?

24 DR. SIEBER: Yes.

25 DR. SIEBER: It screws up the carbon, too.

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1 CHAIRMAN WALLIS: Yes, but this is a fact  
2 that they are talking about. Does CHECWORKS take  
3 account of flow patterns and two-face flow in the  
4 steam line?

5 MR. CROCKETT: In the steam line, the  
6 industry has regarded that as being so close to dry  
7 that it is essentially non-susceptible, and we do some  
8 analysis and testing. But at large the plants  
9 consider that to be dry, and not susceptible, the main  
10 steam line.

11 CHAIRMAN WALLIS: When do you worry about  
12 what steam for fact?

13 MR. CROCKETT: We have seen no indications  
14 in the industry of wall loss in the main steam lines.

15 CHAIRMAN WALLIS: So this is a non-issue?

16 MR. CROCKETT: Yes, that's correct, and as  
17 long as the steam does not get any worse, we do not  
18 see this as an issue.

19 MR. HAEGER: I guess the point is that he  
20 is asking why the --

21 CHAIRMAN WALLIS: Well, the 99.8 percent.

22 MR. HAEGER: I guess it was just to show  
23 a representative input to the fact.

24 CHAIRMAN WALLIS: Maybe we should move on.

25 MR. HAEGER: Yes, let's go on.

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1 DR. FORD: Could I just check? All you  
2 are expecting is a one foot per second increase in the  
3 feed water line?

4 MR. CROCKETT: Well, the earlier higher  
5 velocity was before the feed pumps, and now we have  
6 three feed pumps going, and this higher velocity  
7 downstream of that in the final feed water, and so it  
8 is not that 5 or 6 percent throughout. It is just the  
9 way that it unfolded in here.

10 What is the impact on the wear rates, and  
11 another thing that I would like to bring up at this  
12 time is that we have been fairly proactive in material  
13 upgrades, and putting in chrome moly and materials  
14 that are not susceptible to flow accelerated  
15 corrosion, and that has given us a stronger position  
16 at all our plants.

17 And that is consistent with where the  
18 industry is, and we are trying to be proactive so that  
19 even the lines that we are doing now and that we are  
20 looking at, the scope as time goes on, we continue to  
21 reduce susceptible lines.

22 DR. FORD: So is that first one a chrome  
23 moly?

24 MR. CROCKETT: No, I am not talking about  
25 chrome moly in any of this. This is still facts

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1       susceptible lines. Once I make it chrome moly, it is  
2       not longer susceptible.

3               In the wear rates, we saw that we had some  
4       mild increases and some decreases, and when I first  
5       reviewed the data, the uprate data, I wanted to know  
6       what systems are doing what.

7               And so feed water obviously is a  
8       significant consequence, and the worst wear rate, or  
9       the highest absolute value was this 21 mils per year.  
10       There were some lines that had a higher percentage  
11       increase. Like the reactor water cleanup was at one  
12       mil per year, and that had a 33 percent increase, and  
13       so that was 1.3 mils per year.

14              CHAIRMAN WALLIS: These feed water line  
15       wear rates are actually measured as well as  
16       calculated?

17              MR. CROCKETT: Yes, sir. We go out with  
18       ultrasonic inspection --

19              CHAIRMAN WALLIS: When you measurement  
20       something like 19 mil per a year on your --

21              MR. CROCKETT: That is correct. That is  
22       correct.

23              DR. FORD: Now, you predict that it is  
24       going to go to 21 mils per year, and so presumably you  
25       have got some faith that the CHECWORKS is correct, and

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1 presumably in your fact management, you compare --

2 MR. CROCKETT: We always compare measured  
3 wear with predicted wear, and that allows you to  
4 refine your predictive analysis.

5 DR. FORD: And what would you sigma value  
6 be on that?

7 MR. CROCKETT: Well, what the EPRI  
8 guidelines are for the predictive analysis is to come  
9 up with a line correction factor that ranges from .5  
10 to 2.5, and you get a confidence once your comparison  
11 is predictive to measure comes closely together.

12 If it does not come closely together, then  
13 you have to do more work, more inspections  
14 essentially.

15 DR. FORD: Is that a kind of fudge factor?

16 MR. CROCKETT: Well, it is a continual  
17 refinement of comparing it, yes. The line correction  
18 factor shows you how close you are.

19 DR. FORD: What I am trying to get at is  
20 that you have only got -- you are only predicting a  
21 two mils per year change.

22 MR. HAEGER: I think the next slide will  
23 answer what you are asking.

24 DR. FORD: I mean, does this mean  
25 anything?

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1 MR. CROCKETT: That's why we don't believe  
2 it is a significant impact is what you are going to  
3 see in the conclusions.

4 MR. HAEGER: I think the next slide is  
5 really what he is talking about.

6 MR. CROCKETT: Okay. How do we deal with  
7 these changes? That's exactly right. On the lines  
8 that have increased wear rates, we have brought out  
9 next scheduled inspection closer. So if we are  
10 looking at R-17 right now, we are at our 17, and the  
11 next scheduled inspection was perhaps R-20, and we may  
12 have pulled that back to R-19.

13 MR. HAEGER: Meaning the refueling outage.

14 MR. CROCKETT: The refueling outage, yes,  
15 I'm sorry. And what we have the dash there for, the  
16 1.1 factor of save, we increase our wear rates by 10  
17 percent to account for uncertainties, variations, and  
18 to give us a little more conservatism.

19 And then as I mentioned earlier, we  
20 reinspect at least one cycle before we anticipate  
21 hitting the minimum wall thickness.

22 DR. FORD: Are you ever go to advance at  
23 a rate -- well, are you ever going to hit the minimum  
24 wall thickness?

25 MR. CROCKETT: Typically, we do not. Our

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1 inspection program has been pretty successful. We  
2 don't walk on water. Sometimes things wear slightly  
3 faster, and that's why we incorporate the factor of  
4 safety.

5 DR. SIEBER: Well, CHECWORKS is really  
6 intended to tell you where to inspect.

7 MR. CROCKETT: That's correct.

8 DR. SIEBER: And the official number that  
9 you get is the number that comes off of the thickness  
10 gauge, the UT thickness gauge.

11 MR. CROCKETT: That's correct, yes, sir.  
12 And I would like to emphasize that in this next  
13 bullet that we are going to continue to perform  
14 inspections on susceptible lines, and compare them to  
15 the predictions, and we are going to continue to  
16 upgrade material.

17 When we see a line that is wearing, we are  
18 not going to get their management wear. It is not  
19 cost effective to me to keep going out and seeing  
20 something that is wearing, and uninsulating scrapple  
21 and then UT it.

22 After we do that several rounds, we are  
23 going to upgrade it with fact resistant material. And  
24 this was your comment earlier, the last bullet, that  
25 whenever appreciable wall loss occurs, we expand the

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1 sample, which means that we look upstream and  
2 downstream.

3 And we look in sister trains and that type  
4 of thing to make sure that we bounded the conditions  
5 of the wear. What we found is that we are bounded by  
6 industry experience, as well as our predictive codes.

7 The predictive analysis has been revised  
8 to determine potential impacts, and the inspections  
9 for the affected components have been accelerated  
10 where it is appropriate. Inspection data is  
11 incorporated into the program and it will continue to  
12 be incorporated.

13 In conclusion, the uprated conditions do  
14 not significantly affect flow accelerated corrosion at  
15 Dresden and Quad Cities.

16 DR. FORD: I have another question. If  
17 you don't have any platinum eroding --

18 MR. CROCKETT: Platinum in the feed water  
19 lines?

20 DR. FORD: Platinum from Noble Chem.

21 MR. HAEGER: Can anybody help us with  
22 that? Tim, did you hear the question?

23 MR. T. HANLEY: This is Tim Hanley again.  
24 The only part of the feed water lines would be up to  
25 the check valve to the vessel, the last check valve

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1 that was injected into the reactor water cleanup  
2 system. So it would only be that portion up to the  
3 last check valve.

4 MR. CROCKETT: Bill Burchill will be next.

5 MR. BURCHILL: Good afternoon. My name is  
6 Bill Burchill.

7 CHAIRMAN WALLIS: Welcome, Bill. I have  
8 to say that you are twice as old as the last time that  
9 I saw you.

10 MR. BURCHILL: Well, Grant, you have not  
11 changed at all. Graham and I did some great things  
12 about 25 years ago together, right? Or was it 30.  
13 Gosh, it has been a long time.

14 My name is Bill Burchill, and I am the  
15 Director of Risk Management for Exelon, and on my left  
16 is Larry Lee from Aaron Engineering. Larry did most  
17 of the risk evaluations that we are going to be  
18 talking about today. So hopefully he will get a  
19 chance to participate here.

20 On the next slide, I have outlined the  
21 topics that we are going to cover. Principally, there  
22 are two types of risk evaluations that we did; those  
23 that were quantitative, and both of a full  
24 quantification of the PRA mode; and also some limited  
25 individual special effects quantifications, and then

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1 the qualitative evaluations. And we will talk about  
2 both of those.

3 CHAIRMAN WALLIS: ACRS will tell you that  
4 there is no such thing as qualitative risk  
5 evaluations.

6 MR. BURCHILL: Yes, I have talked to  
7 George about that, and I am fully aware of his  
8 position. Thank you though for reminding me. The  
9 purpose of this risk evaluation -- and I want to start  
10 out by saying that we use generally accepted figures  
11 of merit for risk, which is CDF and LERF.

12 So those were applied and those are the  
13 figures of merit that as you know are called out in  
14 Regulatory Guide 1.174. We estimated the change in  
15 both CDF and in LERF using the full power internal  
16 events model, and that was the only model that we  
17 actually did a full quantification evaluation.

18 For other risk sources, external events,  
19 and the shut down state, we did qualitative  
20 evaluations, although with some numerical evaluation  
21 included.

22 The other important aspect of this was  
23 that it helped us to identify parts of the PRA that  
24 would be impacted EPU plant changes, and that will  
25 guide us then in updates to the PRA that will be used

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1 to properly represent the as built as operated plant  
2 when EPU conditions are implemented.

3 A brief outline and the methods. Of  
4 course, we had to identify the plant configuration  
5 changes that were due to EPU, and most of those had  
6 been outlined already today.

7 We looked at the hardware changes, and the  
8 procedure changes, operating condition changes, and  
9 set point changes. And in each case, we looked at  
10 what those changes would impact within the PRA  
11 evaluation models.

12 We used recently upgraded PRA models for  
13 both plants. These are not the models that were used  
14 for the IPE studies. They are significantly upgraded  
15 models, and both upgrades were completed in 1999.

16 And in both plants the upgraded PRAs have  
17 been reviewed by the BWR owners group certification  
18 peer review process. In each case, we identified the  
19 elements of the PRA that are affected, and I will go  
20 over those in somewhat more detail in the next slide.

21 The next two bullets will be the  
22 foundation for why you will see a number of  
23 differences between the numbers that I will show you,  
24 and those that you have seen earlier in the afternoon.

25 PRA by its very nature uses realistic

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1 evaluation techniques. It compares with realistic  
2 success criteria, and limits, and therefore some of  
3 the numbers that I am going to speak to will be  
4 different from ones that you heard earlier, and if you  
5 wish, I will go back and explain some of those  
6 differences.

7 When we looked at the impact, we used  
8 sensitivity studies, and we did not do a full update  
9 of the PRA. We looked at individual parts of the PRA,  
10 and we changed those parts as we felt that they were  
11 appropriate to represent the impact of the EPU  
12 conditions.

13 And then finally as a benchmark, we  
14 compared the results to the guidance for risk  
15 significance given in Reg. Guide 1.174. As you know,  
16 this is not a risk informed submitted, but we felt  
17 that that guidance was a useful comparison for a  
18 benchmark.

19 Now, we reviewed each of the PRA technical  
20 elements, and in particular we looked at initiating a  
21 bench, and we looked at whether there were any new  
22 initiating events, or whether there were any changes  
23 to existing initiating events in the PRA.

24 We looked at success criteria. For  
25 example, changes due to EPU and boil down times, and

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1 reactor pressure vessel inventory makeup, rates, pool  
2 heat load, RPV, over pressure protection and  
3 depressurization.

4 Every one of those as you can readily  
5 imagine mechanistically can impact what the success  
6 criteria are. So in each case, we did look at that,  
7 and either evaluate that it was insignificantly, or if  
8 we saw that there was a significant impact, actually  
9 put it in the PRA and see what influence it had.

10 We looked at all of the system changes  
11 that were made, both hardware and set point, and we  
12 looked for whether or not those system changes  
13 produced any new scenarios, and also whether it  
14 impacted the failure rates that were assumed within  
15 the PRA.

16 Similarly then we looked at data to see  
17 whether or not the increased duty on some of the  
18 equipment would impact some of the PRA reliability  
19 data.

20 Probably the biggest area that was  
21 identified, and I think you can readily imagine is in  
22 the operator response area. There are a large number  
23 of operator responses in a PRA. Failures by the  
24 operator generally contribute to on the order of 30 to  
25 50 percent of the core damage frequency in a PRA.

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1           So it is a very significant contributor.  
2           So we evaluated in each case the most significant  
3           operator actions in the PRAs. In both cases, that was  
4           on the order of two dozen actions which had a FSAR  
5           vastly greater than .005 or a raw greater than one.

6           Those are the typical values used to  
7           determine risk significance, or I'm sorry, a raw  
8           greater than two. And we also looked at time critical  
9           operator actions.

10           But we looked at structural responses,  
11           which are particularly important of course in  
12           containment response. We looked at quantification,  
13           and in that regard, you look at whether or not the  
14           risk profile changes, which gives you an indication of  
15           whether or not there has been anything new introduced.

16           We looked at individual cut sets, and we  
17           also looked at whether or not our truncation was  
18           adequate at the uprate conditions. And then the  
19           embodiment of all of that shows up in looking at the  
20           event tree sequences.

21           We did do a number of additional thermal  
22           hydraulic calculations, many of them with a map code,  
23           to evaluate the impact of the changes due to time to  
24           boil down, and times to core damage.

25           The next two slides outline in general the

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1 qualitative impact on the PRA, and I will follow that  
2 with then an explicit evaluation summary of the  
3 quantitative impacts.

4 I would like to preface this by saying  
5 that we didn't find any new accident types, which is  
6 of course no real surprise, and we found no  
7 significant changes to the existing accident scenarios  
8 in the PRA.

9 We found no changes in system  
10 dependencies, and of course that is a very important  
11 aspect of plant modeling. And we found no  
12 vulnerabilities that were produced by the PRA, or by  
13 the EPU rather.

14 We did find limited logic structure  
15 changes relative to operator actions, and then of  
16 course changes in the human error probability of some  
17 of the actions.

18 Now, the things that we did find under the  
19 operating condition area was the decreased decay heat  
20 load reduces times to boil down pool temperature  
21 limits and times to core damage itself.

22 This obviously puts more limit on --

23 CHAIRMAN WALLIS: Hold, please. I am  
24 trying to figure out the grammar here. Reduces. I  
25 thought that this read that it reduces pool

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1 temperature limits and reduces core damage, and  
2 reduces qualifying evidently came after.

3 MR. BURCHILL: It reduces the time to,  
4 yes.

5 CHAIRMAN WALLIS: It doesn't reduce time  
6 to pull temperatures limits, or I guess it does.

7 MR. BURCHILL: Times to is qualifying  
8 everything after it, and the impact there is primarily  
9 as you can imagine on the operator action times, the  
10 response times.

11 Now, recognizing that, and the fact also  
12 is that most of the operator response times of  
13 interest are in a fairly long time frame, and so you  
14 are talking mostly response times that are greater  
15 than 20 or 30 minutes.

16 So the ultimate quantitative impact is  
17 generally fairly small. Increased ATWS power levels  
18 and peak pressures; again, more limiting success  
19 criteria, and reduced time for operator action.

20 And then again the increased required  
21 number of feedwater and condensate pumps. This has  
22 the potential for increasing the turbine trip  
23 initiating event frequency, because of the fact that  
24 with all of the pumps operating, any individual pump  
25 tripping off may have the potential for producing a

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1 turbine trip.

2 CHAIRMAN WALLIS: Increased ATWS power  
3 levels and peak pressures; isn't that controlled by  
4 valves opening, and it actually increases the peak  
5 pressure?

6 MR. HAEGER: And that is what that second  
7 bullet is saying; more limiting success criteria for  
8 ATWS, in terms of the number of valves.

9 CHAIRMAN WALLIS: Pressure controlled by  
10 the valves opening?

11 MR. HAEGER: Yes. And one of the success  
12 criteria is how many valves open.

13 CHAIRMAN WALLIS: I thought the peak  
14 pressure stayed the same, but more valves had to open  
15 in order to keep it the same. And how you are  
16 actually saying the peak pressure itself does go up?

17 MR. BURCHILL: In a realistic calculation,  
18 the peak pressure will go up and you will need more  
19 valves to stay below the limit. So both occur.

20 CHAIRMAN WALLIS: Because of the set  
21 points.

22 MR. BURCHILL: Right. Now, on the last  
23 point that I made here, because this is a fairly  
24 significant one, this is the only place where we saw  
25 a potential increase in an initiating event frequency,

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1 the evaluations that were done were done early before  
2 a completion of the recirc runback feature that was  
3 discussed earlier, and so they do not take any credit  
4 for that recirc runback.

5 We believe that with the recirc runback  
6 that there would be no increase in initiating event  
7 frequency, except in the case of a recirc runback  
8 failure, simply because of the fact that you would not  
9 have the single pump tripping leading to a turbine  
10 trip.

11 And in the next slide, we talk about the  
12 system effects, and specifically to the point that we  
13 were just talking about, an over pressure protection.

14 We find that an increased number of  
15 reactor safety and relief valves is required for over  
16 pressure protection. As you know on these plants,  
17 there are 13 valves available. The current success  
18 criteria is 11 valves to hold the pressure.

19 And in the case of the EPU, we found that  
20 would increase to 12 valves. The increased number of  
21 reactor relief valves required for emergency  
22 depressurization on any of these plants, there are  
23 five valves, and currently only one valve is required  
24 for emergency depressurization.

25 Under the EPU conditions, we judge that

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1 that would go up to two valves. So this modifies the  
2 success criteria for transient small and medium LOCAs,  
3 and again for ATWS.

4 And we looked a numerous BOP and set point  
5 changes, as well as logic changes, which produced  
6 negligible risk, and most all of these changes were  
7 described by John Nosko at the beginning of this  
8 discussion.

9 I want to note in particular that the electrical  
10 load fast transfer that I think was mentioned earlier,  
11 and talked about by Mr. Sieber, that feature, and the  
12 addition of the condensate pump trip on LOCA, were  
13 both found to have a negligible impact.

14 Their impact is conceptually on an  
15 increased loop frequency, loss of off-site power and  
16 initiating event frequency. But when we went through  
17 the quantification, we found that in fact the increase  
18 was extremely small compared to the existing loop  
19 frequency assumed in the model.

20 DR. SIEBER: I don't know whether you are  
21 going to get to this later or not, but in the success  
22 criteria for valves and the way you modeled it, it  
23 seems that the overriding failure mechanism was common  
24 cause?

25 MR. BURCHILL: True.

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1 DR. SIEBER: And could you explain how you  
2 treated common cause failures in your analysis?

3 MR. BURCHILL: Certainly. You want to go  
4 through some of the specifics in each case?

5 DR. SIEBER: Yes. It doesn't have to be  
6 real detailed, but I would like to understand it.

7 MR. LEE: Okay. This is Larry Lee from  
8 Aaron. So initially the success criteria was one of  
9 five valves for depressurization. So it would be a  
10 common cause of all five valves failing to open.

11 So now that the success criteria is 2 of  
12 5, you would need common cause failure of any four of  
13 the valves. So the common cause failure rate  
14 increased by approximately a factor of two from around  
15 1-E minus 4, up to about 2-E minus 4.

16 DR. SIEBER: And so you came to your  
17 detailed analysis using beta factors?

18 MR. LEE: Yes.

19 MR. BURCHILL: Okay. The next slide is  
20 Slide 77, and if we can have that up. This is the  
21 slide that we will probably spend most of our time on,  
22 or at least proportionately on slides, and I will even  
23 try to time this one.

24 Mention was made earlier that the Dresden  
25 and Quad plants are similar, but not identical. And

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1 this of course is true in the PRA representation.  
2 Some of the key features, the Dresden plant has an  
3 isolation condenser, and it has a dedicated shut down,  
4 decayed heat removal system.

5 In the Quad plant, we have a dedicated  
6 high pressure safe shutdown make up pump. We have no  
7 isolation condenser. There are a number of  
8 differences in the electrical area, and each of those  
9 are represented in the PRA, and then lead to a  
10 difference being found in the quantitative importance  
11 of either those systems or their failure.

12 We looked at about 15 different model  
13 changes that were quantified with the full PRA  
14 sensitivity studies, and we looked at a number of  
15 other model changes, where we looked specifically, for  
16 example, at just the change in the human error  
17 probability.

18 And we found that it was negligible, and  
19 then did not include that in the full model  
20 quantification. This table then in some detail gives  
21 you the most important ones that we found, in terms of  
22 carrying through to actually having some significance  
23 in the eventual impact on CDF.

24 And by significance, we looked at anything  
25 that was on the order of one percent or more as being

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1 significant. And what you will see is that there are  
2 three groups.

3 One is the impact on the turbine trip  
4 initiating event frequency, which is on the first  
5 line, and as I mentioned that is the only initiating  
6 event frequency that we found impacted.

7 The next five are in the human error or  
8 the human operation or action category. And then the  
9 last is in the success criteria category, the one that  
10 we have already talked about with respect to  
11 depressurization.

12 I will briefly speak to each of these, and  
13 if I am going into too much detail, please don't  
14 hesitate to stop me. I am sure that everyone would  
15 like to get on to something else.

16 In the turbine trip initiating event  
17 frequency, you will see that there is a range  
18 represented there for the PRA model change, and the  
19 size of that range is not indicative of any  
20 significant difference between the plants.

21 It is indicative of a difference in the  
22 modeling technique that was used to derive the  
23 numbers. In the Quad Cities case, we used a  
24 simplified fault tree of a fairly conservative nature,  
25 and that led to the higher number that you see there,

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1 the 18 percent change.

2 I'm sorry, that was the 2-1/2 percent  
3 change. In the Dresden case, we looked at actual  
4 turbine trip data from a seven year period, and then  
5 we made an evaluation of whether each one of those  
6 trips would have actually been aggravated by the EPU,  
7 or in fact would have occurred under EPU conditions.

8 And so what that led to was the 18 percent  
9 change that you see. In quantitative terms, Quad  
10 Cities initiating event frequency changed from 2 to  
11 2.05 per year, and Dresden's changed from 1.14 to 1.35  
12 per year.

13 Now, those changes, when put into the PRA  
14 model, then lead to the CDF contribution increase of  
15 the one or less than one to 2-1/2 percent.

16 Again, I would remind you that if we had  
17 accounted for the recirc pump run back feature that  
18 that would essentially be zero. It would be  
19 negligible.

20 Each of the five operator actions has to  
21 do with times being reduced somewhat for the operator  
22 to take action. In most cases, we simply scaled these  
23 times relative to heat load because most of them are  
24 driven by heat load.

25 The times that we are talking about in

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1 general are in the 20 to 25 minute range being reduced  
2 to on the order of 16 to 20 minutes. So we are  
3 talking about relatively long action times. We are  
4 talking about more or less a 20 percent decrease in  
5 each case.

6 DR. KRESS: But what is the time on Item  
7 4 on that one?

8 MR. LEE: Line 4?

9 DR. KRESS: SPC during ATWS.

10 MR. LEE: Right. There are two time  
11 frames there. There is an early time frame, and I  
12 think we talked earlier -- I don't remember if we  
13 talked the time frame earlier. On the licensing  
14 analysis, it is shorter.

15 But in the PRA analysis, which is a  
16 realistic analysis, the short time to act is 6  
17 minutes. And we looked at the thermal hydraulic basis  
18 of that and found that that did not change under EPU  
19 conditions. For the longer time to act, that went  
20 from 20 down to 16 minutes.

21 MR. HAEGER: That was line 3, I think, and  
22 so --

23 MR. BURCHILL: He said line 4, but then he  
24 said SLCS. So, I think he was talking about SLCS.

25 DR. KRESS: It was SLCS that I was talking

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1 about.

2 DR. SIEBER: Do you have another one that  
3 was down as long as 10 minutes, I guess.

4 MR. BURCHILL: Yes, it went from 10 to 8-  
5 1/2 minutes. I think it had to do with ADS.

6 DR. SIEBER: ADS during --

7 MR. BURCHILL: And what happened was that  
8 when we evaluated that, that changed and that was well  
9 less than one percent impact. That's why you don't  
10 see it on this chart.

11 DR. SIEBER: All right.

12 MR. BURCHILL: Now, one other thing to  
13 point out, that on the second line there is a range of  
14 zero to 1.4, and on the fourth through fifth line, it  
15 is zero to one. Those zeros are somewhat artificial  
16 because of the fact that what we found that the actual  
17 HEP that was in the PRA model in each case was a  
18 fairly conservative value.

19 So that conservatism in and of itself  
20 masked any impact. However, looking at the other PRA  
21 for a very similar plant, we found more realistic  
22 values, and we were able to then vary them to give the  
23 range of influence that you see there.

24 On the last line, the one point that I  
25 would like to make there, because it is a unique one,

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1 is that the inadvertent opening of the relief valve,  
2 or a stuck open relief valve sequences, and the  
3 increased common cause failure probability that we  
4 just talked about, is the only place where we actually  
5 found a modified sequence to occur.

6 If you think about this pre-EPU, we only  
7 had one valve required for the depressurization, and  
8 therefore if we had that one valve open through an  
9 IORV or an SOFV, we would depressurize.

10 With two valves being required for  
11 depressurization, even though you have one valve  
12 inadvertently opening or stuck, you still have to  
13 depressurize. So there is a new branch that gets  
14 added to that event tree to accommodate the fact that  
15 the second valve has to be opened.

16 And Larry has already described the change  
17 in common cause. I would also note that you don't see  
18 on this chart an impact due to the success criteria  
19 change on the overpressurization. That was found to  
20 be very small, well less than one percent.

21 We also looked then at the level two risk.  
22 In other words, the containment risk influence. We  
23 used a methodology that is described in NEUREG/CR-  
24 6595.

25 This is a fairly conservative methodology,

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1 and it has been reviewed and endorsed by NRC for risk-  
2 informed submittals. But it does lead to fairly  
3 conservative results as we will see in a moment.

4 There are two groupings of impact that we  
5 want to consider here. The first three bullets  
6 discuss the disposition of the end states from the  
7 level one analysis. And that is actually the  
8 methodology that is described in the NEUREG/CR-6595.

9 It involves a binning technique where a  
10 binning of the source terms, or fraction of  
11 radionuclide inventory is used. That is unaffected by  
12 the EPU. The actual release frequency in each bin is  
13 proportional to the level one result.

14 But the impact of EPU will be specific to  
15 each bin, depending upon the distribution. The second  
16 three bullets are the risk impact on the containment  
17 response itself. So there are in fact been  
18 containment responsive ventries that could attach then  
19 to the actually end states of each of the level one  
20 bins if you will.

21 There were very minor changes in the Level  
22 2 HEPs, and very minor changes in accident progression  
23 timing, and decay heat load, and a negligible change  
24 in the timing that we found to containment failure, on  
25 the order of several minutes over a several hour

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1 period.

2 So what we found then was that the EPU has  
3 a very minor impact on the Level 2 portion of this  
4 analysis, but the overall impact on LERF is  
5 essentially proportional to or similar to Level 1.

6 The quantification results then are given  
7 in the next slide. The base PRA results are given in  
8 the first group there under the first bullet. Again,  
9 these plants are similar, but not identical, and for  
10 the reasons that I cited before, as well as others, we  
11 do not have identical CDF or LERF based values,  
12 although I would point out that these are pretty darn  
13 close.

14 CHAIRMAN WALLIS: Why is LERF so close to  
15 CDF?

16 MR. BURCHILL: Because of the conservatism  
17 in the 6595. This is about --

18 CHAIRMAN WALLIS: You might not have the  
19 containment.

20 MR. BURCHILL: You usually expect it to be  
21 on the order of 10 to 20 percent. So this is very  
22 conservative. To be frank with you, it becomes an  
23 economic decision. If we can use it and still meet  
24 regulatory requirements, we will.

25 And at the time that we find that that

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1 won't work, we will go to something more extensive.  
2 That will probably be during license renewal. Now,  
3 the impact of EPU is quite small on both CDF and LERF,  
4 and in fact if you look at the impact on CDF, for both  
5 plants, adding up all the little pieces, even though  
6 there are somewhat differences in the mix, they both  
7 come out to be an impacted 2.4 times 10 to the minus  
8 7 per year, which I think you have seen in the  
9 submittals or in the RAI responses.

10 The difference in percent then is entirely  
11 due to difference in base value. It is not a  
12 difference in the absolute impact. In the terms of  
13 LERF, there is a little bit of a difference. Quad  
14 Cities has a face value of 1.3 times 10 to the 7th,  
15 and Dresden is 1.4 times 10 to the 7th.

16 I would note that these results,  
17 percentage wise, are very similar to what has been  
18 seen in other evaluations for other plants. The last  
19 point is that we did compare these results to the  
20 guidelines for risk significance in Reg Guide 1.174.

21 Just to refresh, Reg Guide 1.174 for the  
22 magnitude of CDF and LERF for these plants,  
23 differentiates between small risk and very small risk  
24 at 10 to the minus 6th for CDF changes, and 10 to the  
25 minus 7th for LERF changes.

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1           So if you compare what we found on --  
2 well, I think I said that wrong. Yes, 10 to the minus  
3 6 on CDF, and 10 to the minus 7th on LERF. So the  
4 change that we found in CDF in both cases is a about  
5 a quarter of the way up to the threshold between very  
6 small risk and small.

7           And so we conclude that we are well below  
8 any concern here, and that the CDF is well within the  
9 very small risk region. Relative to LERF, we are just  
10 barely over the line to small risk, and considering  
11 the conservatism that we just talked about if we were  
12 to do that realistically, it seems pretty obvious that  
13 we would be in the very small risk change arena.

14           An area of considerable concern, and if  
15 Dr. Apostolakis were here, we would have some  
16 considerable discussion on are the uncertainties. We  
17 looked at the uncertainty and the base full power  
18 internal events PRAs using standard techniques.

19           We looked at risk importance measures, and  
20 we found that the distribution of them and their  
21 general magnitudes were normal. We looked at  
22 sensitivity studies and we looked at the pertinence of  
23 the various equipment.

24           We looked at failure rates, and we looked  
25 at operator actions using ranges of 5 to 10 times the

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1 human error probabilities, and we compared the results  
2 to what is reported in NUREG-1150.

3 But we found no uncertainty sources beyond  
4 those that are identified in NUREG-1150, but we did  
5 not do an explicit quantitative uncertainty analysis  
6 of this EPU risk evaluation.

7 However, if we were to take the  
8 uncertainty range cited by 1150, which it appears we  
9 would agree with, the range there is cited to be on  
10 the order of 5 to 6 times the calculated point value.

11 So if we were to apply that to the delta-  
12 CDF that we have calculated, we would be just at the  
13 borderline or slightly above the range, the threshold  
14 between very small and small risk.

15 And if we were to apply it to the delta-  
16 LERF, we would still be within the small risk range,  
17 even considering the conservatism. So we think that  
18 adequately covers the question of uncertainty.

19 Now, we looked at four different areas,  
20 and qualitatively the present PRA does not explicitly  
21 include internal flooding in the quantification.

22 However, in the IPE studies, we did look  
23 at flooding, and it was found to be a very small risk  
24 contributor, estimated to be on the order of one  
25 percent of the base CDF of the plants.

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1                   Therefore, although the dominant full  
2 power internal event model changes would apply,  
3 because they would be applied to such a small fraction  
4 of the CDF, they are essentially negligible.

5                   We found no new initiating events  
6 increased during initiating event frequencies, and so  
7 the bottom line conclusion is that the internal flood  
8 is not impacted by the EPU.

9                   Relative to external events, the IPEEE for  
10 both plants concluded that external events other than  
11 fire or seismic do not pose any significant risk of  
12 severe accidents.

13                   So what we focused on in this study then  
14 was the fire and the seismic area. The fire  
15 evaluation or both plants used recently revised fire  
16 PRAs in the 1999 to 2000 time frame, and we completely  
17 redid the fire PRAs for both plants, and resubmitted  
18 the associated parts of their IPEEEs.

19                   We did not do a full requantification.  
20 Instead, we looked at the dominant scenarios in each  
21 of these fire PRAs, and qualitatively evaluated  
22 whether or not they would be impacted by EPU  
23 conditions.

24                   In both cases, we examined the top 10  
25 scenarios. In Dresden, the dominance scenario is a

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1 control room exposure fire, and it contributes about  
2 40 percent of the fire CDF. In Quad Cities, the  
3 control room fire is about 10 percent.

4 Basically, in both cases the control room  
5 scenarios were evaluated with a very conservative  
6 conditional core damage probability of about .5, and  
7 so any impact of EPU would really be subsumed in that,  
8 and that is not very satisfying.

9 So what we did then was that we looked at  
10 what were the actual operator actions that that .5  
11 represents, and we said how much time does he have to  
12 take those actions.

13 And then again looking at what would be  
14 the actual impact. And, for example, if you take  
15 Dresden, and the time to go out and initiate the  
16 isolation condenser for a fire scenario, and the  
17 dominant fire scenario that we are talking about, is  
18 about 35 minutes.

19 We estimated that would shrink to about  
20 33, and then the time beyond that to restore makeup to  
21 the isolation condenser would also change by the type  
22 of figure that I mentioned previously, the 20 to 16  
23 minutes.

24 So again a very small impact. The other  
25 major type of scenario is decay heat removal scenario,

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1 and the dominant scenario at Quad is a fire in the  
2 reactor feed pump area, and that contributes about 25  
3 percent and leads to a loss of decay heat removal.

4 And that Dresden has about 20 percent of  
5 its various scenarios tied up in to decay heat removal  
6 sequences. Again, the impact on those sequences  
7 through the human error probabilities is very small,  
8 because the operator has very long times to respond in  
9 each one of these cases, on the order of 30 minutes.

10 CHAIRMAN WALLIS: Are these fire risks  
11 -- the CDF contribution is bigger than the full power  
12 CDF that you were talking about?

13 MR. BURCHILL: Right. It is about an  
14 order of magnitude higher mainly driven --

15 CHAIRMAN WALLIS: So we were worrying  
16 about some increases of five percent in something  
17 which is considerably smaller than this fire risk?

18 MR. BURCHILL: Right. The impact of the  
19 way that we model fire ignition frequencies, most  
20 people who do fire PRAs believes is what drives  
21 results of this type. This is not an unusual  
22 comparison between fully quantified fire risk and  
23 other internal events.

24 So I think it is fair to say that it is  
25 now a significant debate within the PRA community as

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1 to how to even compare these two. In most cases, we  
2 don't. We simply address them one at a time, because  
3 we know that the fire risk evaluation techniques are  
4 so conservative.

5 Other changes in the success criteria --  
6 for example, the number of relief valves, has a  
7 negligible impact, and the ATWS related changes that  
8 we have talked about would be negligible due to the  
9 low probability of a fire induced ATWS.

10 We didn't find any new fire initiating  
11 events or increased fire initiating event frequencies,  
12 meaning new fire ignition frequencies. So again we  
13 felt that the EPU had a negligible impact on fire  
14 risk.

15 The seismic area was the third area of  
16 qualitative evaluation, and we do not have seismic  
17 PRAs for either one of these plants. In both cases  
18 the IPEEE requirements were satisfied using the EPRI  
19 seismic margin analysis method.

20 So we looked at those seismic margin  
21 analyses to determine whether or not there was  
22 anything in there that would be significantly impacted  
23 by the increase in power.

24 We found no impact on the seismic  
25 qualifications of the structure systems and

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1 components, and I think that is no surprise. We did  
2 look at the potential impact of increased stored  
3 energy on blow down loads, and we found that that was  
4 also a very small -- and which as you heard earlier --  
5 the same conclusion as the deterministic analysis of  
6 the containment that Mark Kluge described very early  
7 in the afternoon.

8 We also looked at the impact on ultimate  
9 heat sink issues, which I think we are going to defer  
10 and discuss with you in the open issues area. I will  
11 just forecast that the result there was determined to  
12 be minor, but we will describe to you under that  
13 discussion, which requires really understanding the  
14 scenarios.

15 But we will describe to you how we  
16 quantitatively evaluated that using a scenario  
17 specific event tree.

18 CHAIRMAN WALLIS: So you are going to come  
19 back to that?

20 MR. BURCHILL: We are going to come back  
21 to that.

22 CHAIRMAN WALLIS: And the staff has some  
23 issues with that.

24 MR. BURCHILL: Right, the staff has some  
25 issues, and we are going to try to address those under

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1 our open issues discussion.

2 DR. SIEBER: I do have one question which  
3 you can probably answer in one sentence. I think it  
4 is Dresden ultimate heat sink operation. And it talks  
5 about using the canal to run through the parking lot  
6 there.

7 MR. BURCHILL: Yes.

8 DR. SIEBER: And then having time to  
9 refill it by pumping into it?

10 MR. BURCHILL: Yes.

11 DR. SIEBER: And then the safety  
12 evaluation talks about portal pumps. Are those pumps  
13 at your site at Dresden, and they can be wheeled out  
14 and operated?

15 MR. KLUGE: This is Mark Kluge. Those  
16 pumps are not on-site, but given the large amount of  
17 time available to stage those pumps, we have standing  
18 contracts with pump vendors, and our belief and our  
19 procedural basis is that we can obtain those pumps in  
20 ample time to refuel the UHS.

21 MR. BURCHILL: Not to preempt Mark's later  
22 presentation, but we are talking about days.

23 DR. SIEBER: I'll check that.

24 MR. BURCHILL: Yes, he will talk about  
25 that, but we are talking about days, just so we don't

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1 leave that on the table. So our conclusion again is  
2 that EPU has a very minor impact on seismic risk, but  
3 the particular place where it may have impact is going  
4 to be described later.

5 Lastly, in the qualitative area, we did  
6 look at shutdown risk. Again, we do not have shutdown  
7 PRAs for these two plants. However, it is easy to  
8 recognize that the dominant full power internal events  
9 PRA model changes in most cases do not apply, either  
10 because the times are different or because the  
11 equipment requirements are different.

12 We did not see any new initiating events  
13 or increased initiating event frequencies. It is  
14 obvious, of course, that the higher decay heat load  
15 will increase boil down times. And then we will have  
16 some minor impact on human error probabilities.

17 Now, recognize that most of the operator  
18 actions during a shutdown are of a recovery nature.  
19 They are recovering, for example, a lost decay heat  
20 removal system, or something of that type. And they  
21 mostly occur in the many minutes to hours time frames.

22 So it is not surprising that there would  
23 not be much of an impact. There is one place where  
24 there is an impact, and that is that there is a number  
25 of backup systems that are available for decay heat

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1 removal.

2 Some of these are low capacity systems,  
3 and they are not able to be used until the decay heat  
4 load drops sufficiently so that their heat removal  
5 capability is sufficient to match decay heat.

6 And so there is a somewhat shortened time  
7 for that to occur, but again we are talking about  
8 something out in days, and a shortening of a few days  
9 on that. So, a very minor impact there.

10 And the last thing is that we do manage  
11 our risk during shutdown using configuration risk  
12 management techniques. We use a commercial tool  
13 available that was developed by EPRI called ORAM, and  
14 I am sure that you have heard of that.

15 It is a defense in depth monitor, and  
16 there is no impact whatsoever of EPU on the use of  
17 that tool, and how it would be applied during an  
18 outage. So again we conclude that EPU has a  
19 negligible impact on shutdown risks.

20 So, I will summarize, and I note, Dr.  
21 Wallace, that you are getting tired of me saying over  
22 and over again negligible, small, minor, but that is  
23 what we found.

24 The risk impact was evaluated using  
25 standard PRA methods, and with deference to George,

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1 both quantitative and qualitative. The quantified  
2 impact was a small percentage of the current plant  
3 risk, and it is well within the criteria that the Reg  
4 Guide 1.174 specifies for either a very small or small  
5 risk impact.

6 DR. KRESS: Let me ask you a question  
7 about that.

8 MR. BURCHILL: Yes.

9 DR. KRESS: I seem to recall in Reg Guide  
10 1.174 that they had an absolute limit on LERF of 1  
11 times 10 to the minus 5?

12 MR. BURCHILL: What you are thinking of is  
13 in Reg Guide 1.177. There is an absolute limit of 5  
14 times 10 to the minus 7th on delta risk, which is  
15 essentially a CDP, or what is now being called an  
16 ICCDP, which is a change in risk, multiplied by the  
17 time over which that risk exists. I think that is the  
18 only place that there is an absolute.

19 DR. KRESS: I thought that the 1.174 was  
20 divided up into regions.

21 MR. BURCHILL: Yes, there is.

22 DR. KRESS: And if you were in a region  
23 above --

24 MR. BURCHILL: Oh, that's true. If your  
25 base is too high, you're right.

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1 DR. KRESS: Too high, and that value for -  
2 - well --

3 MR. HAEGER: If I could reply to that.

4 MR. BURCHILL: Which one are you putting  
5 up?

6 MR. HAEGER: The Quad CDF impact.

7 MR. BURCHILL: Yes, that's fine. If you  
8 want to turn it on.

9 MR. HAEGER: Do you want to do LERF or  
10 CDF?

11 DR. KRESS: LERF.

12 MR. HAEGER: You can do it either way.

13 DR. KRESS: Yes, they are almost the same,  
14 but we will do the LERF. Now, the dark region is the  
15 region where no changes are allowed.

16 MR. HAEGER: Unacceptable, right.

17 DR. KRESS: And on that LERF line that is  
18 like something times 10 to the minus 5 --

19 MR. BURCHILL: Actually, it is about 10 to  
20 the minus 4. This is 10 to the minus 5, and this is  
21 10 to the minus 6. And what we found is that we were  
22 right about here.

23 MR. HAEGER: Here is where the box is.

24 MR. BURCHILL: Yes, where the box is, and  
25 we are about here. This is where we are, and the 1.37

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1 times 10 to the minus 7. And at a base of 4 times 10  
2 to the minus 6.

3 DR. KRESS: And if you were to add in the  
4 low power shutdown, and add in the seismic, and add in  
5 the fire, would that move you very far in that  
6 direction?

7 MR. BURCHILL: I can give you a judgment  
8 on that, because we don't have it quantified, but I  
9 would judge that it would be very small movement in  
10 this direction.

11 DR. KRESS: The other question that I have  
12 is the LERF value where that line is drawn was derived  
13 on the basis of the quantitative prompt fatality  
14 health objective.

15 Now, if you increase the power, it seems  
16 to me that that line ought to move back the other  
17 direction, because you are increasing the fission  
18 product inventory, and if you were to back out the  
19 same fraction or release value from the prompt  
20 fatality value that you calculate, then the allowable  
21 value of that line ought to move back in the other  
22 direction by at least -- well, it is not linear  
23 because it has to do with a lot of the iodine.

24 MR. BURCHILL: The way that these explicit  
25 boundaries were derived is a mix of philosophy in

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1 numerics, but there is a relationship that is known,  
2 and that there is about a 3800 megawatt thermal  
3 assumption that went into the calculation of trying to  
4 relate these figures of merit to the public health  
5 figure.

6 DR. KRESS: They use sort of an average  
7 plant.

8 MR. BURCHILL: But they use a very big  
9 plant.

10 DR. KRESS: And your plant is much smaller  
11 than that big one, and so that --

12 MR. BURCHILL: A 3800 megawatt thermal.

13 DR. KRESS: So that would move the line in  
14 the other direction, and it also uses an average site  
15 source. So your site is probably much less populated  
16 than the average, considering a large LOCA.

17 MR. BURCHILL: I know that we are at a  
18 lower power level, but I don't know if we are much  
19 less populated than what was used there. But I know  
20 that in the deliberations that have been going on  
21 about revisions to Reg Guide 1.174, that has been on  
22 the key points, is whether or not the 3800 that was  
23 actually assumed to set these boundaries needs to be  
24 looked at, in terms of actually making these lines as  
25 you suggest variable.

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1           But if we were to actually take the power  
2 level that we are talking about, in theory the line  
3 would actually move to the right. I wouldn't  
4 subscribe to that by the way. I don't think that is  
5 a proper interpretation of how these were done.

6           DR. KRESS: I was just trying to figure  
7 out how close you were actually to that line.

8           MR. BURCHILL: Well, we know this line  
9 should not be moving this direction, and I believe  
10 that if we were able to do an explicit calculation of  
11 the other risk sources, it obviously wouldn't move  
12 very far this way.

13           And if I were to actually be doing that,  
14 I would do an explicit level-2, and this thing would  
15 drive down here anyway.

16           DR. KRESS: Okay.

17           MR. BURCHILL: That is the real key,  
18 because I have got a factor of -- a minimum of two,  
19 and probably a 4 or 5 in conservatism in it.

20           CHAIRMAN WALLIS: Well, your box there is  
21 for this FPIE risk evaluation?

22           MR. BURCHILL: Yes, it is. This is a  
23 legend box and I don't know why there is two of them.  
24 And then this one is the result.

25           MR. LEE: That is what we say in region-2

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1 and region-3.

2 CHAIRMAN WALLIS: You didn't give us  
3 numbers for fire related CDF, but the staff has some  
4 numbers which seem to be pretty high. I mean, 6 or 7  
5 times 8 to the minus 5.

6 MR. BURCHILL: Correct.

7 CHAIRMAN WALLIS: And they are much bigger  
8 numbers than any of these.

9 MR. BURCHILL: Yes, but that is typical.

10 CHAIRMAN WALLIS: But if we put down the  
11 same picture, it would take you over into the greater  
12 region.

13 MR. BURCHILL: If I were to blindly add  
14 those numbers, it would do that. But before I would  
15 do that, I would go in and I would do a whole lot of  
16 work on my fire ignition frequencies, and I would do  
17 comp calculations, and --

18 CHAIRMAN WALLIS: You would bring that  
19 down?

20 MR. BURCHILL: I would certainly be able  
21 to bring them down by on the order of --

22 CHAIRMAN WALLIS: There seems to be a bit  
23 of uncertainty about the right number to use for these  
24 fire related CDFs then.

25 MR. BURCHILL: I'm sorry?

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1 CHAIRMAN WALLIS: There seems to be a lot  
2 of uncertainty about what to use for these fire  
3 related CDFs.

4 MR. BURCHILL: Well, the fire risk  
5 analyses were a part of the IPEEE, which as to  
6 identify vulnerabilities. I think there is a lot of  
7 question about using them as numerically comparable to  
8 internal events.

9 CHAIRMAN WALLIS: Maybe we will ask the  
10 staff what they think about that. Do you know what  
11 that hurricane like region is over to the left there  
12 on your picture, the dark blob there?

13 DR. KRESS: That is the crest mark.

14 MR. HAEGER: That is actually on the  
15 screen.

16 MR. BURCHILL: So our conclusion is that  
17 we are well within the acceptable ranges on the 1.174,  
18 which we have just looked at in anguishing detail, and  
19 that the impact from external events and shutdown is  
20 either negligible or minor.

21 So overall, if we had the last slide up,  
22 but it doesn't matter, we believe that the EPU risk  
23 impact is acceptable. I would like to make one  
24 further comment. I believe that the staff did an  
25 extremely thorough evaluation in this case.

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1           And particularly recognizing that this is  
2 not, quote, a risk informed submittal, but the fact  
3 that we did get asked a large number of questions, and  
4 they spent some times with us in July as you have  
5 read, I was actually very impressed with their  
6 inquiry.

7           So I just wanted to put that on the  
8 record. I know that is something a licensee normally  
9 says, but I thought that they did a very good job.

10           CHAIRMAN WALLIS: They were equally  
11 impressed with your answers to their inquiries.

12           MR. BURCHILL: Well, I am pleased to hear  
13 that. Okay. I would now like to introduce Mark Kluge  
14 now, who will continue with the discussion of open  
15 items.

16           CHAIRMAN WALLIS: Thank you very much,  
17 Bill.

18           MR. BURCHILL: You're welcome. A pleasure  
19 to meet with you again.

20           MR. KLUGE: This is Mark Kluge, and we are  
21 going to cover four of the open items from the staff's  
22 safety evaluation. I will be discussing ECCS net  
23 positive suction head requirements, and the ultimate  
24 heat sink that we touched on just a moment ago.

25           Then I will bring John Freeman back up to

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1 talk about the standby liquid control system, and an  
2 issue involved with that. And then finally Tim Hanley  
3 will discuss the large transient testing that came up  
4 earlier in the presentation.

5 The pre-EPU basis for both Dresden and  
6 Quad Cities was that credit for a containment  
7 overpressure is required for adequate ECCS MPSH.  
8 Because that is the case, our procedures, our  
9 training, are all focused on operator awareness of  
10 that need, and the proper actions to maintain MPSH.

11 The EPU impacts on this condition are that  
12 using a limiting analysis with the proper conservative  
13 assumptions to minimize containment pressure, we have  
14 an overall need to increase the containment over  
15 pressure credit for the EPU condition.

16 Dresden and Quad Cities installed larger  
17 suction strainers as to the rest of the BWR fleet, and  
18 the staff had some open issues with our methodology in  
19 calculating the head loss for those suction strainers.

20 DR. SIEBER: That was independent of --

21 MR. KLUGE: That was independent of EPU.  
22 However, EPU provided us the opportunity to address  
23 those issues.

24 DR. SIEBER: If that issue is not  
25 resolved, I take it that EPU is. What is the caboose

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1 behind that train?

2 MR. HAEGER: Well, we have submitted  
3 material to the staff now that we believe resolves  
4 that issue.

5 DR. SIEBER: Well, it takes two to resolve  
6 it; you and them.

7 MR. KLUGE: But we believe that the  
8 calculation that we have performed now addresses all  
9 of the staff issues with the head loss methodology.  
10 It does result in an increase in head loss at a given  
11 ECCS flow.

12 The overall effect from EPU on the Dresden  
13 and Quad Cities plants, we have a reduced period of  
14 pump cavitation in the short term over the existing  
15 analysis. That small period of cavitation has been  
16 previously evaluated and shown to be acceptable based  
17 on some testing that we did of the ECCS pumps some  
18 years ago.

19 CHAIRMAN WALLIS: Do you actually know the  
20 flow characteristics of the pump when it is  
21 cavitating?

22 MR. KLUGE: Well, there are a couple of  
23 points to remember here. First of all, the ECCS  
24 analysis has to assume a limiting single failure,  
25 which means inherently that analysis does not use as

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1 much flow as does our limiting MPSH analysis.

2 Our worse case here is when all of the  
3 ECCS pumps are operating, and in fact not only are  
4 they all operating, but we assume a loop select  
5 failure such that the LPCI pumps are all pumping out  
6 the break.

7 CHAIRMAN WALLIS: But when the pump  
8 cavitates, what do you do? Do you put in some reduced  
9 pumping capacity as a function of lower suction head  
10 or something, or what?

11 MR. KLUGE: For the assumptions in the  
12 ECCS analysis, this cavitation wouldn't occur because  
13 of the reduced number of pumps available.

14 CHAIRMAN WALLIS: I am just saying that  
15 there is a period of pump cavitation?

16 MR. KLUGE: There is a period of pump  
17 cavitation if I assume that all the ECCS pumps are  
18 operating. That period is limited by operator action  
19 at 10 minutes into the event, and you --

20 CHAIRMAN WALLIS: Well, what is the  
21 consequence of having that cavitation? You reduce the  
22 flow or what do you do?

23 DR. SIEBER: You trip a pump.

24 CHAIRMAN WALLIS: Do you assume that there  
25 is no flow or what?

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1 MR. KLUGE: Well, the actual pump  
2 operating characteristics would be slightly reduced  
3 flow.

4 CHAIRMAN WALLIS: Slightly reduced flow?

5 MR. HAEGER: From all ECCS pumps running,  
6 and what Mark is trying to say is that the ECCS  
7 analysis assumes a single failure, and so the flow  
8 rates are much less there.

9 The cavitation won't get you anywhere near  
10 that low of a flow rate. So we are bounded by the  
11 ECCS LOCA analysis.

12 MR. KLUGE: And not to berate the point,  
13 but the ECCF analysis also uses lower flows from the  
14 available pumps; whereas, we assume full flow capacity  
15 to do the MPSH analysis. So there are different  
16 inherent assumptions in these two analyses

17 MR. PAPPONE: This is Dan Pappone. The  
18 flow that they are talking about, there will be a  
19 degradation in the flow, but that degradation will not  
20 go from the actual value down to our analysis value.

21 The value that we assumed in the analysis  
22 was below the grated flow value. So effectively we  
23 have accounted for it in the analysis. Another factor  
24 is that --

25 CHAIRMAN WALLIS: Well, maybe I should ask

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1 a simpler question. Even if you have this pump  
2 cavitation, you are able to calculate that you have  
3 enough flow?

4 MR. PAPPONE: That's right.

5 CHAIRMAN WALLIS: And this is based on  
6 some model or some understanding of effective  
7 cavitation on the pump flow characteristic?

8 MR. PAPPONE: Right.

9 MR. KLUGE: Another factor is the time  
10 when it occurs, and the time when we would expect this  
11 cavitation to occur after we have reflooded the vessel  
12 and terminated the core heat up.

13 So that part happens in the first few  
14 minutes, and the cavitation is out at -- well, let's  
15 say when we get past the reflooding in 3 or 4 minutes,  
16 and the cavitation is out in the 5 minute range, the  
17 5 or 6 minute range.

18 DR. SIEBER: Plus, there is an implicit  
19 assumption that there is no vortexing associated with  
20 the cavitation; is that correct?

21 MR. KLUGE: Flow characteristics were  
22 based on testing that we did some years ago.

23 DR. SIEBER: Where you actually induced  
24 cavitation?

25 MR. KLUGE: Where we induced cavitation in

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1 an ECCS pump identical to those installed in Dresden  
2 and Quad Cities. That cavitation was allowed to  
3 continue for a period of an hour, which is far in  
4 excess of what we are talking here.

5 DR. SIEBER: Right.

6 MR. KLUGE: And when the pumps were  
7 inspected, the results of that cavitation were that  
8 the pump operability had not been affected.

9 DR. SIEBER: Well, the vortexing using  
10 affects the flow in a major way, and I presume that  
11 during the test that you also did flow measurements to  
12 see what the degradation was?

13 MR. KLUGE: That's correct.

14 DR. SIEBER: And maybe you could tell us  
15 the percentage. Was it 90 percent, or 80 percent, or  
16 what?

17 MR. KLUGE: Well, I don't have that  
18 information in front of me, but just to echo what Dan  
19 said, in every case, even the degraded flow would give  
20 us much lower than what was required for the accident  
21 analysis.

22 DR. SIEBER: All right. Okay.

23 MR. KLUGE: Moving on to the long term  
24 reduced pump flow and the long term compared to the  
25 previous licensing basis analysis, that is partly a

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1 factor of the increase during our head loss, and  
2 partly a factor of the increased suppression pool  
3 temperatures.

4 But again all flow requirements, both for  
5 core cooling and containment cooling, continue to be  
6 met. The next two slides show graphically the  
7 available over-pressure above that which is credited  
8 in the analysis.

9 If you compare Dresden and Quad Cities,  
10 there are some minor differences due to plant  
11 specifics, such as different heat exchanger capacity  
12 and piping configuration.

13 CHAIRMAN WALLIS: Now, what does credited  
14 in the analysis mean? Is it what the NRC allows you  
15 to us?

16 MR. HAEGER: Yes.

17 MR. KLUGE: Yes, what we have requested.

18 CHAIRMAN WALLIS: Oh, so you have  
19 requested something less than what you think is  
20 available?

21 MR. KLUGE: That's correct. And all this  
22 information has been submitted to the staff.

23 CHAIRMAN WALLIS: When you say credited,  
24 you mean that is what you need really isn't it?

25 MR. KLUGE: That is what will appear in

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1 our operating license.

2 CHAIRMAN WALLIS: That is what you need  
3 and so you are claiming you have got more available  
4 than what you need?

5 MR. KLUGE: Yes.

6  
7 MR. HAEGER: That's correct.

8 DR. SIEBER: It's always a good idea.

9 CHAIRMAN WALLIS: And this available is  
10 calculated with some sort of conservatism which goes  
11 the other way from when you are trying to calculate  
12 the loads on the containment when you are conservative  
13 in the other direction?

14 MR. HAEGER: That's correct. There is a  
15 number of different assumptions made that limit the  
16 containment pressure that is available.

17 MR. KLUGE: For instance, the containment  
18 sprays are assumed to operate since they bring the  
19 pressure down. However, the assumed containment heat  
20 removal capability is the minimum, which of course  
21 drives the suppression cool temperature up.

22 Moving on to the summary slide, we used  
23 acceptable methods to determine the suction strainer  
24 head loss and the NPSH requirements. Although we do  
25 experience short term pump cavitation, we devaluated

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1 that condition and it has no detrimental effect on  
2 pump operability or meeting the required flow.

3 And the long term flow rates are  
4 acceptable, and the operators are aware of the need to  
5 maintain MPSH per their emergency operating  
6 procedures. Therefore, we conclude that the ECCS pump  
7 and NPSH remains acceptable under EPU conditions.

8 CHAIRMAN WALLIS: Does the staff agree  
9 with that?

10 MR. KLUGE: They haven't indicated to the  
11 contrary. We do think we have addressed all of the  
12 issues with the methodology that we considered.

13 CHAIRMAN WALLIS: So they have not come  
14 back to you and said yea or nay yet?

15 MR. KLUGE: That's correct.

16 MR. HAEGER: They have not formally  
17 replied to us.

18 MR. KLUGE: Next, I would like to discuss  
19 the Dresden ultimate heat sink and I will ask Larry  
20 Lee to come back up here to handle the risk portion.

21 As was previously mentioned, the Dresden  
22 ultimate heat sink consists of the intake and  
23 discharge canals to the plant. And there is a picture  
24 being put up so we can see what we are talking about.

25 Dresden 2 and 3 intake valve spans from

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1 this point to this point, and the discharge runs from  
2 this point to this point. To give you some idea of  
3 the scale from the plant to the south end of the lake  
4 is approximately 3 miles.

5 So we are talking 2,000 foot canals and a  
6 total inventory that we are looking at in those canals  
7 once we postulate that the river level has dropped to  
8 a point, the separation is about 6 million gallons.

9 The ultimate heat sink inventory is used  
10 both as makeup to the isolation condensers to maintain  
11 safe shutdown, and for diesel generator cooling water.  
12 As indicated before, the canals are then replenished  
13 by means of portable pumps to ensure long term safe  
14 shutdown, and those actions are all in the current  
15 procedures.

16 CHAIRMAN WALLIS: So whatever it was that  
17 caused the dam to fail didn't also inhibit the arrival  
18 of portable pumps?

19 MR. KLUGE: That is the assumption in the  
20 current licensing basis.

21 CHAIRMAN WALLIS: Well, why should that  
22 be? I mean, something big enough to fail the dam  
23 might --

24 MR. KLUGE: Well, it certainly could have  
25 been a localized effect, such as a river barge,

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1 causing enough damage.

2 CHAIRMAN WALLIS: Or it could be a seismic  
3 event or something?

4 MR. KLUGE: It could be a seismic event.

5 DR. SIEBER: Well, a lot of plants use  
6 fire trucks to do that, and they run around to all the  
7 local fire companies and say if we have this problem  
8 will you support us.

9 And I know of a number of plants that have  
10 made that arrangement. So it is not impossible to get  
11 pumping capacity.

12 MR. KLUGE: That is correct, and as I  
13 indicated previously, we do have standing contracts  
14 with pump vendors to ensure their availability.

15 CHAIRMAN WALLIS: So portable pumps, or  
16 something like a fire truck driving up and hitching up  
17 as a source of water?

18 MR. KLUGE: Well, the source of water in  
19 this case is the lowered river bed.

20 DR. SIEBER: Right. Is it about a half-a-  
21 mile from the river to the plant?

22 MR. KLUGE: Yes, but the required distance  
23 to pump this water is simply over the contour in the  
24 canal that has caused the separation.

25 MR. T. HANLEY: This is Tim Hanley again.

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1 We actually had our ice melt line fail at Quad Cities,  
2 and not this winter, but a winter ago when we had a  
3 fire truck actually perform this same type of thing to  
4 keep our intake structure from freezing over.

5 And we had that well within a shift, and  
6 then portable irrigation pumps also to back that up.  
7 So especially in rural Illinois, there are plenty of  
8 irrigation pumps available if you should need that.

9 MR. KLUGE: And to evaluate the impact of  
10 EPU on the ultimate heat sink, we did a bounding  
11 analysis, which actually credited the inventory only  
12 in the intake canal.

13 And we determined that the available time  
14 for replenishing the canal would decrease from 5-1/2  
15 days to 4 days, which we would still consider an ample  
16 time frame to restore make up means from the lowered  
17 river bed.

18 DR. SIEBER: Would you use water from the  
19 discharge canal? It seems to me that it was pretty  
20 hot, and there is always vapor coming off of there.

21 MR. KLUGE: The assumption in this  
22 particular analysis was not that we use water from the  
23 discharge canal. However, that heat would only make  
24 a significant difference if we were using the water as  
25 a cooling source via heat exchangers. We are just

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1 pumping it into the isolation condenser and boiling it  
2 off.

3 DR. SIEBER: Okay.

4 CHAIRMAN WALLIS: Did you worried about  
5 net positive suction heads for the fire truck pumps  
6 and pumping hot water?

7 DR. SIEBER: They are pumping out of the  
8 river. So the river probably never gets about 90  
9 degrees.

10 MR. KLUGE: That's correct. I would like  
11 to describe the operational scenario here in a little  
12 more detail. The initial makeup to the isolation  
13 condenser is from on-site tanks and the capacity in  
14 those tanks is considerably beyond what we require in  
15 the scenario.

16 An operator action is required to reflood  
17 a bay in the crib house, which due to the lower level  
18 has lost suction. And that action is taken by  
19 installing stop logs and using permanently installed  
20 pumps to reflood the bay.

21 Then that reflooded bay becomes the  
22 suction source to the diesel driven fire pump, which  
23 provides long term makeup to the isolation condenser.

24 I mentioned that the USH also supplies the  
25 diesel generator cooling water pumps. Those pumps

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1 happen to be at a higher suction level than those that  
2 reflood the intake bay.

3 Therefore, if diesel operation is  
4 required, they become limiting as far as the useable  
5 inventory in the bay, and they were accounted for in  
6 the limiting analysis that I described previously.

7 The diesel generator water cooling water  
8 flow path is from the intake canal, and through heat  
9 exchangers, and back to the discharge canal.

10 The procedures then direct the operator to  
11 establish recirculation of that water back to the  
12 intake, which maximizes the use of the available  
13 water, although again we did not credit the inventory  
14 in the discharge canal in the limiting analysis. We  
15 do credit the recirculation path.

16 The lack of a seismically qualified make  
17 up path to the isolation condensers was identified  
18 during our seismic margins analysis. The original  
19 FSAR analysis that was the basis for licensing Dresden  
20 relied on non-seismic equipment, but recognized that  
21 there was a diversity of make up sources available.

22 However, as a result of the seismic  
23 margins analysis, we identified the need for a  
24 modification to provide that seismic makeup path, and  
25 that is scheduled to go into the plant in 2003.

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1           The staff requested that we evaluate the  
2 risk of operating with the current configuration and  
3 in doing that we concluded that EPU had an  
4 insignificant impact on the plant risk for the  
5 scenario, and Larry will talk about that a little  
6 later.

7           The seismic margin success path must also  
8 be able to mitigate a case where a seismically induced  
9 equivalent one-inch LOCA comes about. We analyzed the  
10 situation, and determined that the isolation condenser  
11 and the available ECCS would mitigate the scenario for  
12 at least 24 hours.

13           In order to provide a long term  
14 capability, we identified another modification that  
15 was necessary, and this would use different portable  
16 pumps to make up directly to the containment cooling  
17 heat exchangers, and therefore allow us to maintain  
18 safe shutdown for a longer time period.

19           All the necessary actions to accomplish  
20 this will be put into the plant procedures, similar to  
21 the current required actions. Again, the staff  
22 requested that we analyze the risk for the small LOCA  
23 scenario, and we concluded again that EPU had a very  
24 negligible impact on this risk.

25           And now Larry will describe those focused

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1 risk assessments in some detail.

2 MR. LEE: Hi. This is Larry Lee. So,  
3 consistent with NEUREG or the guidelines provided in  
4 NEUREG-CR 2300, we used standard seismic risk  
5 techniques to estimate the risk for specific scenarios  
6 involving seismic dam failure with failure to the IC  
7 makeup path.

8 And I will speak to a few of the sub-  
9 bullets. First of all, the Dresden site-specific  
10 seismic hazard curve was used from NEUREG-1488, and  
11 the information here is based on the studies performed  
12 by Livermore National Labs, and the curves are judged  
13 to be conservative.

14 In terms of the -- we evaluated the entire  
15 seismic hazard curve by dividing the curve into  
16 discreet .1g intervals so that we could evaluate the  
17 frequency and the seismic impact for each of the  
18 intervals, and then add the risk for each individual  
19 to come up with a total risk for the specific  
20 scenarios.

21 And then the second to the last sub-bullet  
22 is talking about we calculated the human error  
23 probabilities for the pre-and-the-post EPU associated  
24 with the scenarios consistent with how the human error  
25 probabilities were calculated, and the base Dresden

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1 PRA model.

2 And we only credited proceduralized makeup  
3 paths. So we didn't credit any non-proceduralized  
4 actions associated with any proposed modifications.

5 In terms of the results, we analyzed two  
6 cases. The first one is safe shutdown with the IC for  
7 a non-LOCA case, and we found that the delta-CDF  
8 associated with EPU was on the order of 1E-minus 8,  
9 and for a seismic dam failure with a coincidence small  
10 LOCA, the delta-CDF was negligible.

11 DR. KRESS: Did you do an actual CDF?

12 MR. LEE: In terms of the actual CDF for  
13 the pre-EPU, and for the first bullet, for the safe  
14 shutdown with the IC, the CDF was approximately 9.3E-  
15 minus 6. So with the delta of 1E-minus 8, the post-  
16 EPU CDF was approximately negligible.

17 CHAIRMAN WALLIS: Within the --

18 MR. LEE: Yes. For the coincidence small  
19 LOCA case, the pre-EPU CDF was approximately 1.9E-  
20 minus 6 per year, and the probabilities for a seismic  
21 induced small LOCA were based on the Zion analysis  
22 from NEUREG-4550.

23 MR. KLUGE: This is Mark Kluge again. In  
24 summary, we have concluded that EPU has minimal impact  
25 on the ultimate heat sink capability for Dresden.

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1           We will be completing the required  
2 modifications on the previously committed schedule for  
3 the seismic margins, IPEEE outlines, and the risk  
4 impact and increase in risk is very small for these  
5 scenarios.

6           Therefore, the ultimate heat sink is  
7 acceptable for EPU operation. If there are no further  
8 questions, I will ask John Freeman to come back up to  
9 discuss the standby liquid control system.

10           CHAIRMAN WALLIS: Thank you.

11           MR. FREEMAN: This is John Freeman. We  
12 are going to be talking from page 101. The issue  
13 involved here was the information notice that was sent  
14 out a few months ago concerning the standby liquid  
15 control relief valve margin response under an ATWS  
16 scenario.

17           Exelon has looked at the standby liquid  
18 control system for Dresden Unit 2, and concluded that  
19 there would be no interruption of the standby liquid  
20 control flow rate delivered to the reactor under the  
21 analyzed scenario.

22           However, Unit 3 of Dresden and Quad Cities  
23 1 and 2 are still being evaluated, and there is a high  
24 potential that we are going to need to make  
25 modifications to the SLCS relief valves set point in

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1 order to ensure that that valve will not lift and that  
2 it will get our ATWS rule required flow rate to the  
3 reactor.

4 Therefore, the conclusion is that the  
5 standby liquid control is acceptable at EPU conditions  
6 for Dresden Unit 2, and it will be acceptable for Unit  
7 3 of Dresden, and Quad Cities 1 and 2, with the  
8 completion of the modifications we have planned.

9 DR. SIEBER: It would seem to me though  
10 that whether you add EPU or not, that would still be  
11 an issue.

12 MR. FREEMAN: That is correct.

13 MR. HAEGER: Yes, this is not specifically  
14 an EPU issue. This same phenomenon would occur prior  
15 to EPU.

16 MR. HAEGER: Right.

17 DR. SIEBER: Okay.

18 MR. FREEMAN: Okay. If there aren't any  
19 other questions, I will introduce Tim Hanley

20 MR. T. HANLEY: This is Tim Hanley again  
21 from Exelon. The topic that I am going to discuss is  
22 the large transient tests. As you are all aware,  
23 ELTR-1 specifies two large plant transient tests to be  
24 conducted.

25 One is an MSIV closure if the power uprate

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1 goes to 110 percent; and the other one is a generator  
2 load reject if the power uprate is greater than 115  
3 percent.

4 Earlier, a question was asked, well, what  
5 was the basis, a simple one or two sentence, for not  
6 doing these tests. And to begin with, we believe that  
7 it is unnecessary to assure the plant's response, and  
8 I will go over some of the reasons why we believe that  
9 is unnecessary to put the plant through the transient.

10 In both of these scenarios, both the MSIV  
11 closure and the generator load reject, the SCRAM is  
12 initiated off an anticipatory signal. In the case of  
13 the MSIV closure, when the valves are less than 90  
14 percent full open, the SCRAM signal is initiated  
15 inserting the rods, and essentially terminating the  
16 power excursion.

17 And the generator load reject, as the EHC  
18 pressure drops and the turbine control valve bodies to  
19 a certain point, indicating the fact acting solenoids  
20 have actuated that SCRAMs the reactor and terminates  
21 the power excursion.

22 In both tests, feedwater is still  
23 available for level control and in the case of the  
24 generator load reject, the bypass valves are still  
25 available for pressure control.

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1           Most of the major parameters of interest  
2           in the input into determining how the plant is going  
3           to respond are unchanged for EPU. The SCRAM times are  
4           not being changed, and the valve closure times are  
5           being changed.

6           The only thing that has really changed is  
7           the peak dome pressure, which is really essential in  
8           both of these. The beginning dome pressure is not  
9           being changed. The only two parameters that are  
10          changing are the reactor power level and the steam  
11          line flow.

12           DR. SIEBER: And the stored energy.

13           MR. T. HANLEY: Right. You do have  
14          additional stored energy. However, that decays very  
15          rapidly as soon as the SCRAM goes in. In both cases,  
16          you are well within your relief valve capacity are in  
17          one case within the bypass valve capacity.

18           So the real test and the real parameters  
19          of concern in these tests is what is your peak  
20          pressure that you reach, and what is the peak power  
21          that you reach prior to it turning around prior to the  
22          SCRAM being effective, and terminating the excursion.

23           When G.E. originally put these in the  
24          ELTR, they had no experience really with uprating  
25          plants, and they had no basis for assuming that the

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1 ODDYN code that they used to determine the plant  
2 response would be effective for uprated conditions.

3 And since that time, G.E. has concluded  
4 that these tests should no longer be required for  
5 power uprates at a constant pressure up to a certain  
6 level, and I believe it is 120 percent, which we are  
7 not exceeding.

8 CHAIRMAN WALLIS: Where would this large  
9 transient test -- you mean that you actually take the  
10 system to 115 power?

11 MR. T. HANLEY: No, no, no. If your power  
12 uprate goes to 115 percent of your current power  
13 level.

14 DR. SIEBER: These sub-bullets are  
15 misleading.

16 CHAIRMAN WALLIS: They are misleading,  
17 yes.

18 MR. HAEGER: Yes, that is misleading.

19 CHAIRMAN WALLIS: Then you have to test  
20 the ability of the generator to reject load or  
21 something, but you don't -- okay.

22 MR. PAPPONE: This is Dan Pappone. The  
23 tests that we are talking about would be performed at  
24 the uprated power level.

25 MR. CROCKETT: That's correct, but not 115

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1 percent of the uprated power level. If your power  
2 uprate exceeds 115 percent of your original license  
3 power level, then it calls for that.

4 MR. FREEMAN: The original intent was to  
5 perform those tests at the full uprated power level.  
6 The safety analysis that has been done at both Dresden  
7 and Quad Cities has been done using the ODYN code. It  
8 has been benchmarked against BWR test data, and has  
9 incorporated industry experience.

10 MR. BOEHNERT: What BWR test data?

11

12 MR. FREEMAN: Particularly it has been  
13 benchmarked at --

14 MR. HAEGER: It is Peach Bottom, right?

15 MR. ANDERSEN: This is Jens Andersen. The  
16 ODYN code has been benchmarked against full-scale  
17 plant testing, particularly the Peach Bottom turbine  
18 test.

19 MR. BOEHNERT: Were those at uprated  
20 conditions?

21 MR. ANDERSEN: No.

22 MR. BOEHNERT: So what do you have a  
23 benchmark at uprated conditions?

24 MR. ANDERSON: There are start up tests  
25 for other plants that have been performed.

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1 MR. T. HANLEY: In fact, we do have a back  
2 up of a comparison, I believe, KKM.

3 MR. HAEGER: Well, what some foreign  
4 plants have done is do this testing at higher power  
5 levels than Dresden and Quad.

6 MR. BOEHNERT: At 120 percent? At 115?  
7 At 110?

8 MR. HAEGER: Well, it is the thermal power  
9 that they are at, which is higher than Dresden or  
10 Quad.

11 MR. BOEHNERT: So they had a test where  
12 they had done it 120 percent of uprated conditions?

13 MR. HAEGER: I think the one set of data  
14 that we have was 110 percent of their original license  
15 power. But I guess the point that we are making is  
16 that the power levels at Dresden and Quad are at are  
17 lower than the power levels of these units.

18 MR. T. HANLEY: And the beginning dome  
19 pressures are lower than the pressures of these other  
20 units, and so we are within the bounds of where ODYN  
21 has been proven to be effective in determining how the  
22 plant's response will be.

23 We are not extrapolating it out to some place where it  
24 hasn't been proven.

25 MR. BOEHNERT: Do we know how applicable

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1 that plant is to Dresden and Quad Cities?

2 MR. T. HANLEY: Well, I guess the next  
3 bullet on the slide is that ODYN uses plant specific  
4 inputs, models of steam lines and geometries of the  
5 length.

6 DR. KRESS: Are the valves the same at  
7 these plants, the same kinds of valves that you have  
8 to open and close?

9 MR. T. HANLEY: That I can't say for sure.  
10 However, once you isolate the vessel, you essentially  
11 have relief valves left as your pressure protection.  
12 We do know in fact the opening times of our relief  
13 valves, and those are included in there, which would  
14 be included at the other plants in their data.

15 And whether they are exactly the same or  
16 not, that is a specific input that is used in the  
17 modeling.

18 DR. KRESS: Oh, that's part of the  
19 modeling? That's not in ODYN.

20 MR. HAEGER: Valve closure times are  
21 modeled.

22 DR. KRESS: Valve closure times are  
23 modeled.

24 MR. HAEGER: Yes.

25 DR. KRESS: But whether the valves can

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1 actually close during time is another issue.

2 MR. HAEGER: Yes. We will get to that in  
3 the next slide.

4 DR. KRESS: Okay.

5 DR. SIEBER: But if you run the test, you  
6 are going to get all those relief valves and safety  
7 valve actuations at least for relief valves, right?

8 MR. T. HANLEY: We will get relief valve  
9 actuations on the MSIV closure for sure. You should  
10 not get any safety valve actuations, but we will get  
11 relief valve.

12 The power uprate, since the ELTRs were  
13 initially -- was initially approved, they do have  
14 additional operating experience to compare the  
15 predicted plant response to actual plant response.

16 And what it has shown is that the code  
17 adequately predicts the way the plants would respond  
18 under those real conditions. So of those have been  
19 under plant test conditions, and some have been under  
20 unplanned transients, where they have gone back and  
21 collected the data, and compared them.

22 And it does show that the code to  
23 acceptably predict and also bounding predictions,  
24 particularly on peak power and peak pressure. And  
25 Dresden and Quad Cities both have adequate collection

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1 capability.

2 And should we have one of these unplanned  
3 transients, we would of course go back and verify that  
4 the code predictions were as we expected. We have  
5 done extensive code analysis and the --

6 CHAIRMAN WALLIS: You might have an  
7 unintentional test anyway.

8 MR. T. HANLEY: And we have. In fact, at  
9 Quad Cities in the last two years, we have had a  
10 generator load reject and an MSIV closure at full  
11 power.

12 CHAIRMAN WALLIS: And you have already  
13 done the tests?

14 MR. T. HANLEY: Not at our uprated  
15 conditions. Both Exelon and G.E. have analyzed the  
16 major components that affect the large transients, and  
17 those are MSIVs, steam piping, SCRAM signal, safety  
18 release valves, and turbine valves, and the  
19 interaction of those.

20 We have years of operational experience --  
21 unfortunately, some of them awfully recently -- to  
22 show that those components do operate as they are  
23 designed, and we are well aware of their operational  
24 history. And the transient testing does not mean that  
25 these components will respond as designed.

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1 MR. HAEGER: Now, that was to your point,  
2 Mr. Kress, that to look at each of these components,  
3 and really there is nothing in the EPU that would  
4 change their response to the timing or whatever the  
5 particular feature is.

6 MR. T. HANLEY: And in each of them we do  
7 specific component testing on. We do stroke our  
8 relief valves during start up, although some plants  
9 have gotten away doing that due to the relief valves  
10 leaking.

11 But in the MSIVs, we do time their closure  
12 and set their closure time based on to be within our  
13 tech spec limits.

14 DR. SIEBER: And do issues like Stone and  
15 Webster speak to main steam line piping analysis and  
16 supports, and those are factors here that may be  
17 different than they were at your previous rating?

18 MR. T. HANLEY: Those could potentially be  
19 impacted, because you are interrupting a higher flow.

20 DR. SIEBER: You have a big hammer, and it  
21 breaks snubbers and pull things out of the wall, and  
22 all kinds of stuff.

23 MR. T. HANLEY: The other thing to keep in  
24 mind though is that we would be running these tests on  
25 the plants at that power level. So whether you do it

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1 planned or it happens sometimes unplanned, the results  
2 are going to be the same.

3 So from an operational perspective, why  
4 would I induce this transient on the plant unless I  
5 had some real concern about the ability of the  
6 analysis to accurately predict how the plant would  
7 respond.

8 If I break a snubber under a planned -- we  
9 would call it a test, but it is a transient that I am  
10 inducing, or if I break a snubber when the turbine  
11 trips from full power at some other time, the effects  
12 to the operations in the plant are exactly the same.

13 You still have to deal with a broken  
14 snubber, and so that is really kind of my conclusion  
15 in all of this, is that we have limited changes to the  
16 inputs to the plant because we are doing a power  
17 uprated constant steam dome pressure.

18 Most of the other parameters of interest,  
19 with the exception of reactor power and main steam  
20 line flow, are remaining the same. So these are in  
21 fact -- although they are labeled as tests, they are  
22 transients being induced on the plant.

23 And are challenging the equipment of the  
24 plant, and without a compelling reason, it doesn't  
25 seem to me operationally to be prudent to go and shut

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1 all the MSIVs at full power unless there was some  
2 concern that we didn't have high confidence in the  
3 modeling.

4 MR. BOEHNERT: Well, G.E. must have been  
5 concerned. I mean, they initially said you should do  
6 this testing. What changed their mind?

7 MR. HAEGER: Well, like I said, they have  
8 had experience now with some uprates, and it showed  
9 them that everything works out as predicted.

10 MR. T. HANLEY: Well, I should ask G.E. to  
11 respond, but my discussions with them are that in fact  
12 they have submitted a constant power uprate submitted  
13 to the NRC that would no longer require these tests.

14 And we can't use that as a basis  
15 obviously, because it is not approved, but they have  
16 themselves come to that conclusion, and it is based on  
17 their experience that their modeling has accurately  
18 and adequately predicted the plant's response under  
19 uprated conditions.

20 CHAIRMAN WALLIS: So their argument is  
21 that they have already got experience, and there is no  
22 extrapolation beyond experience involved.

23 MR. T. HANLEY: That's correct, and in  
24 fact, Quad Cities and Dresden will be at a lower power  
25 and lower steam line flow rate than a lot of plants

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1 were originally licensed to have.

2 Van Gulf, which I have some experience  
3 with from people that I work with, is over 3,000  
4 megawatts thermal, with a corresponding steam flow  
5 rate. So we are within the bounds where this code has  
6 been proven to be effective in predicting the plant's  
7 response.

8 CHAIRMAN WALLIS: This is again where some  
9 kind of matrix or something would help, and if you  
10 could show that here is the experience base, and here  
11 is where you are going to be with the uprate, and just  
12 as a comparison.

13 MR. HAEGER: For instance, in the material  
14 that we have supplied to the staff, we do show some  
15 specific data from KLL, and I have it here. KKL is at  
16 3130 megawatts thermal, and they were -- and that was  
17 113 percent of their original license thermal power.

18 MR. BOEHNERT: Has the staff accepted your  
19 arguments?

20 MR. HAEGER: That is another open issue.

21 MR. BOEHNERT: That is an open issue?

22 MR. T. HANLEY: That's correct.

23 CHAIRMAN WALLIS: So may be they will  
24 provide this matrix, or whatever it is, and that we  
25 can actually look at and see the comparison between

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1 experience and uprated power in these particular  
2 plants, and see if it is covered.

3 DR. SIEBER: Well, I am not sure that you  
4 can leap right away to the fact that everything is  
5 okay just by saying that some bigger plant did it  
6 before me. I think that it takes more thought than  
7 that.

8 MR. T. HANLEY: But I think that is part  
9 of the consideration. I certainly would be more  
10 concerned had we been uprating to a new higher power  
11 level that no plant had ever been licensed to. So  
12 that is one of the considerations to look at.

13 DR. SIEBER: Well, I think more in terms  
14 of power density, and cubic feet of plant per  
15 megawatts, and --

16 MR. HAEGER: Well, once again this power  
17 density for our plants is lower than other plants that  
18 are licensed currently.

19 DR. SIEBER: I understand. Okay.

20 MR. T. HANLEY: So my final conclusion is  
21 that we shouldn't intentionally put the plant through  
22 what is a significant transient unless there is really  
23 a compelling reason, which we haven't found there to  
24 be one. Any other questions?

25 CHAIRMAN WALLIS: And this gets us to the

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1 end of your presentation?

2 MR. T. HANLEY: Yes, it does. It gets me  
3 actually to the beginning of my next presentation,  
4 which is the implementation, training, and testing.

5 I am going to go quickly what training we  
6 have done for the operators, both classroom and  
7 simulator training, and what testing we will be doing  
8 during the start up.

9 When I talk about the testing, it has been  
10 completed at Dresden, which is going through their  
11 uprate outage right now. With the exception that they  
12 are going to have two hours of delta training that  
13 they will do just prior to uprate just to get the  
14 operators reacquainted with the changes, and what they  
15 will be doing differently when they go about their  
16 current hundred percent thermal power.

17 At Quad Cities, we have only begun this,  
18 and we will complete all of the training before our  
19 February outage on Unit 2, which is our uprate outage.

20 DR. SIEBER: Will all of the MODS be  
21 modeled into your simulator?

22 MR. T. HANLEY: Yes. In fact, they were  
23 modeled in the Dresden simulator prior to their last  
24 session of simulator training, which was all focused  
25 on EPU, and the same would be true for Quad Cities.

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1 Classroom training covered really  
2 everything that we would normally cover going into an  
3 outage; any tech specs or other changes; design  
4 changes, whether they were for EPU or not.

5 We are going to or are covering operating  
6 procedure revisions that are going in, and mostly  
7 those are due to modifications. There are some in  
8 general that are just due to EPU.

9 Some other things that we did is look at  
10 the plant limits and operating condition changes, and  
11 those things include running all the four condensate  
12 pumps, and all three feed pumps, changes in the  
13 operation of the pressure control system for the  
14 turbine throttle.

15 The vessel looked at MELLLA, and the new  
16 power to flow map, and the differences that you may  
17 see during certain transients, such as recirc runback,  
18 and recirc pump trip. And we did cover some operating  
19 experience from other plants that have done uprates.

20 Monticello had some feed flow inaccuracies  
21 that they had not considered when they did uprates,  
22 and Peach Bottom found that they had excessive  
23 vibrations and had to put in another coronary EHC  
24 system, residence compensator.

25 And in fact that got factored in as a

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1 modification that we did at Quad Cities and Dresden.  
2 Fitzpatrick had excessive vibrations that affected the  
3 feedwater heating system, and the air line supplying  
4 those control valves. So we went over a number of  
5 things that had happened at other plants.

6 DR. SIEBER: How is that incorporated in  
7 these to look for these things?

8 MR. T. HANLEY: Well, I will go over --

9 DR. SIEBER: Are do you just depend on the  
10 operators?

11 MR. T. HANLEY: No, this was a heads up to  
12 them, but it is incorporated into our start up testing  
13 programs. So we will have a controlled look at all of  
14 those things as we are going up.

15 DR. SIEBER: Now, your external nuclear  
16 instruments will all be --

17 MR. T. HANLEY: We don't have ex-core. We  
18 have all in-core.

19 DR. SIEBER: All in-core?

20 MR. T. HANLEY: That's correct.

21 DR. SIEBER: Okay. Do they all work?

22 MR. T. HANLEY: Most of the time. We had  
23 some issues with copper migration in some of the SRMs  
24 and IRMs in this last refueling outage that we have  
25 replaced those that were susceptible. So we have had

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1 good response with the nuclear instrumentation.

2 The simulator training began with a static  
3 walk through the similar was set up as full power EPU,  
4 and what they should see when they go in to take the  
5 unit for the first time, and at its new uprated  
6 condition, and just walk around and see where the  
7 different parameters are from where they are used to  
8 seeing it.

9 And just basically to get acquainted with  
10 the plant as you will be seeing it. And we went  
11 through some normal operation scenarios; power  
12 changes, inserting rods, and doing some small recirc  
13 changes.

14 And then did some dynamic scenarios that  
15 we selected to highlight both the differences that  
16 they will see at EPU and the similarities in their  
17 response under these conditions.

18 And we ran through a loss of feed water  
19 heating, and feed water controller failure, high  
20 recirc controller failure, condensate pump trip. And  
21 obviously before a condensate pump trip, the first  
22 thing an operator does is verify the standby pump auto  
23 starts.

24 Well, there is no standby pumps, and so  
25 now the new action is verify the recirc pumps are

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1 running back.

2 DR. SIEBER: Right.

3 MR. T. HANLEY: So we ran through a group  
4 one isolation and a loss of off-site power with a  
5 LOCA, and also a turbine trip without bypass with a  
6 ATWS. Really from the operators experience the --

7 DR. SIEBER: This is a turbine bypass.

8 MR. T. HANLEY: That's correct. So  
9 essentially it is almost the design basis ATWS,  
10 because you give no bypass applicability. Really from  
11 the operator's feedback, they didn't see a lot of  
12 changes in their response to transients or accidents  
13 other than those specifically associated with hardware  
14 changes, like the condensate pump trip.

15 And that really is a credit to the generic  
16 EPGs now that we work with symptom-based emergency  
17 procedures. You are going everything off a parameter.

18 So you are looking at TORUS temperature,  
19 and you are looking at drywell pressure, and you are  
20 taking actions at specific levels of those parameters  
21 before you reach them. So it doesn't really affect  
22 how the operators respond.

23 DR. SIEBER: Have you had to change your  
24 emergency response guidelines for the uprate?

25 MR. T. HANLEY: Yes, there will be some

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1 minor changes to those.

2 DR. SIEBER: Like control points, and sub-  
3 points, and things like that?

4 MR. T. HANLEY: Right. We are in fact  
5 -- I believe that it is part of this submittal, and it  
6 may be a separate one. We are changing our low level  
7 SCRAMs at that point from 8 inches to zero inches.

8 So that obviously is an entry point into  
9 the EOP. So that will be a change that goes in. But  
10 the overall strategy of the Ops has not changed, and  
11 really the operators, their feedback was that they  
12 didn't see a significant difference in the way that  
13 they attack it as transient.

14 DR. SIEBER: Has the power uprate created  
15 any walk arounds for the operator that otherwise would  
16 not exist?

17 MR. T. HANLEY: We will only be able to  
18 tell that for sure once we get to those conditions.  
19 As designed, operators are always skeptical, which is  
20 good.

21 But as a design, we should not have  
22 controllers left in manual that are supposed to be in  
23 automatic. We should not have additional monitoring  
24 required once we get through our testing program.

25 DR. SIEBER: That's right.

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1 MR. T. HANLEY: And those are the things  
2 that we are on the lookout for, as designed, and none  
3 of those are built into this uprate.

4 But those will be the things that we will  
5 have to look for when we get to the new license power  
6 condition to make sure that they are identified, and  
7 get put in our program, and get fixed in a timely  
8 basis. So we don't intend to incur any operator work  
9 arounds to reach our new power, licensed power.

10 CHAIRMAN WALLIS: Well, then all the  
11 modifications will be -- except for records update,  
12 will be complete, tested, and --

13 MR. T. HANLEY: Well, digital feedwater,  
14 which is not being installed as part of EPU, but we  
15 are taking advantage of that for particular input into  
16 the recirc runback, obviously we will be doing start  
17 up testing as we start up from that. So there will be  
18 testing that goes on with this.

19 DR. SIEBER: So the run back won't occur  
20 until you put that in?

21 MR. T. HANLEY: No, it will. It will all  
22 be in during the outage, but all the testing on that  
23 now won't be complete you are at power, and that is  
24 the only way to test it.

25 But our intention is not to have feed

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1 water heat level control valves left in manual, or  
2 have the emergency dumps on those bias partially open.  
3 So those are the things that the operators are  
4 concerned about.

5 And we have done a lot of analysis, and  
6 the increased shell pressure should increase the flow  
7 through the same sized valves. So we shouldn't have  
8 an issue with the drains on the feedwater heaters.

9 DR. SIEBER: And you will find that out  
10 probably.

11 MR. T. HANLEY: Probably, and that's --  
12 well, as operations, we are keeping our eyes out for  
13 anything that didn't come out the way that we were  
14 told it was going to.

15 That really covers the training portion of  
16 it, and so I was going to go on to the testing. The  
17 way that we are going to perform our testing is do one  
18 power increase a day, and approximately 3 percent, and  
19 stop there, and collect all of our data, and compare  
20 it to the predicted value acceptance criteria.

21 And look for anything that would keep us  
22 from increasing power the next day, and if we have to  
23 make minor system adjustments, and if we have to go  
24 back and reevaluate, and if we have to go back and  
25 hold power there, that's the point where we will do

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1 it.

2 We will be increasing along a constant  
3 flow control line to limit the variables that we are  
4 changing at one time. So, really essentially we will  
5 be increasing recirc pump speed over the days to  
6 increase power.

7 We are going to start collecting our  
8 steady state data at 90 percent of our current licensed  
9 thermal power for the systems that we are monitoring  
10 for vibration data for the main steam and feed lines.

11 And we will actually be getting that data  
12 at 50 percent of our current license thermal power.  
13 But for the systems, we have got good operating  
14 history, and we just want to get a base line at 90  
15 percent of our current license power level.

16 DR. SIEBER: Are you going to do anything  
17 special with the turbine since you are getting a new  
18 high pressure turbine?

19 MR. T. HANLEY: And we are changing the  
20 diaphragms on the control valves, and what we will be  
21 doing is we always monitor turbine vibrations, and we  
22 always do --

23 DR. SIEBER: And that is standard on the  
24 start up?

25 MR. T. HANLEY: Right, and we will be

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1 doing our normal control valve stroking to ensure that  
2 the other control valves can compensate adequately for  
3 one control valve closing.

4 But the high pressure turbine itself will  
5 have a unique MOD test associated with it, and not  
6 related to EPU. In fact, Dresden right now is  
7 installing a new high pressure turbine.

8 And so when they start up, even though  
9 they won't be licensed EPU, they will be doing their  
10 generic MOD test for that.

11 DR. SIEBER: Now, you have a boreless  
12 spindle?

13 MR. HAEGER: Boreless rotor?

14 DR. SIEBER: Yes. Well, a spindle. We  
15 always run a line through the bore, and if you don't  
16 have a bore, then I am not sure how you align.

17 MR. HAEGER: The question, George, is if  
18 you don't have a bore, how do you do the alignment?

19 MR. NELSON: This is George Nelson. They  
20 are using laser alignment techniques, which are  
21 primarily off of the opening of the shaft.

22 DR. SIEBER: And we shoot through the  
23 shaft with a laser.

24 MR. T. HANLEY: And these tests will be  
25 conducted with a dedicated testing team lead by an

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1 SRO. There is one assigned to Quad Cities and one  
2 assigned to Dresden. We are also sending our people  
3 to Dresden for our start up testing when they begin  
4 their power ascension testing.

5 And then those people from Dresden will  
6 becoming to Quad to make sure that we capture any  
7 lessons learned about that. We are doing specific  
8 signal and system response testing for the two  
9 systems, control systems, that are being significantly  
10 altered for EPU.

11 The pressure control system for the main  
12 turbine, the control valves will actually control  
13 turbine throttle pressure at a lower pressure than it  
14 does right now to maintain reactor pressure at a  
15 thousand-five, because it is controlling at a new set  
16 point, and we will be doing specific pressure  
17 incremental changes on it to make sure that it has a  
18 stable response.

19 And that it does not oscillate  
20 divergently, and we are also going to do a pressure  
21 regulator fail over test to make sure that the back up  
22 pressure regulator takes control when it is supposed  
23 to, approximately three pounds higher than the normal  
24 pressure regulator.

25 The feed water level control system, we

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1 operate normally in three element control, and so the  
2 input is from feedwater and steam flow have been  
3 changed.

4 We are going to do some specific testing  
5 of that unrelated to our digital feedwater at Quad  
6 Cities and Dresden, which went digital a number of  
7 years ago.

8 And doing incremental level changes and  
9 verify the system response as stable. We will put one  
10 feed rate valve in manual and make adjustments to it,  
11 and verify that the other valve can control  
12 adequately.

13 And then we will do that at varying power  
14 levels to ensure that it is stable over the range of  
15 normal operation for them. We will be doing specific  
16 system equipment performance monitoring.

17 These are mainly geared towards the  
18 balanced plant systems, which are the ones being  
19 modified for EU. Each parameter we have gotten from  
20 the system engineers are predetermined acceptance  
21 criteria.

22 And the performance parameters, as we go  
23 up through our 3 percent increases each day, that is  
24 where we will be collecting the data, and comparing  
25 that, and seeing if any changes need to be made to the

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1 plan, and to the system operation before we continue  
2 our increase.

3 In addition, there are the 10 balance of  
4 plant systems that we have selected, and we will also  
5 be monitoring the recirc pumps since we will be  
6 operating those at a higher RPM than we are currently  
7 and also the reactor, and just verifying that we don't  
8 see anything odd happening there.

9 Specifically, we are increasing the flow  
10 in the feed water and steam -- main steam line piping,  
11 and want to verify that we don't have excessive  
12 vibration and it is difficult to try to determine  
13 ahead of time where that may occur.

14 And so we are putting vibration monitoring  
15 equipment, both inside and outside containment. We  
16 will be getting lower power vibration data, which I  
17 talked about earlier, and we are getting about 50  
18 percent power.

19 And then the acceptance criteria are  
20 established from the ASME stress analysis limits on  
21 what is acceptable and what is not. And we won't  
22 exceed any of those limits.

23 In conclusion, we have completed at  
24 Dresden extensive training, and we will complete at  
25 Quad Cities extensive training for the operators,

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1 which has used both the design features and are  
2 operating and experience from other plants, the  
3 testing plans, incremental and comprehensive, and  
4 gives us good guidance before we increase power to the  
5 next level.

6 And the project implementation will ensure  
7 that EPU is implemented as designed. Do you have any  
8 questions? If not, with that, I will turn it over to  
9 Jeff Benjamin, Vice President of Licensing and  
10 Regulatory Affairs.

11 MR. BENJAMIN: Since I am on the verge of  
12 having to say good evening, I will make my remarks  
13 brief. First of all, we are pleased to have the  
14 opportunity this afternoon to present our submittal.

15 As I think we articulated at the beginning  
16 of this presentation, our objective at the outset of  
17 this project was to increase the power output for the  
18 Dresden and Quad Cities stations, while maintaining  
19 the appropriate operating margins, and continuing to  
20 operate the units safely and reliably.

21 I think the project team that has worked  
22 for the past two years in partnership with our  
23 vendors, have met those objectives as we talked about  
24 today, and as supported by the bullets up on the  
25 slide, I think our package before the Commission for

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1 their review and approval also reflects those points.

2 I want to particularly emphasize what Tim  
3 touched on last, and that is that we have had the  
4 opportunity to go through three power uprates in our  
5 fleet over the past couple of years, and have learned  
6 through each one of those the importance of our change  
7 management program, including the operator training,  
8 testing program, and the monitoring program.

9 And I am confident that the infusion of  
10 those lessons learned, as you just heard Tim  
11 articulate a piece of. We will also add confidence  
12 that the assumptions that went into the power uprate  
13 package will be borne out and tested out appropriately  
14 as we bring the unit up on line, and as we test it out  
15 at the higher power levels.

16 So, in summary, we believe that the  
17 submittal that we have before the staff demonstrates  
18 the acceptability of our proposed power uprate, and  
19 that completes our presentation, subject to any  
20 questions.

21 CHAIRMAN WALLIS: Thank you very much. Do  
22 we have any questions from the committee or  
23 consultant?

24 Now, you are going to make a presentation  
25 to the full committee, and you are going to compress

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1 this presentation by a factor of eight or something  
2 like that?

3 MR. HAEGER: Yes, and we would expect some  
4 guidance from you on that.

5 MR. BENJAMIN: I think we would anticipate  
6 working with you on the areas of emphasis that you  
7 would like to see, and obviously we would compress  
8 that material accordingly to facilitate the discussion  
9 within your schedule constraints.

10 CHAIRMAN WALLIS: I think things that you  
11 can show in a diagram would be helpful; like with  
12 numbers with the containment analysis and the  
13 conclusions from the ECCS and so on, and show that you  
14 met some criteria specifically.

15 CHAIRMAN WALLIS: Okay.

16 MR. BENJAMIN: I also assume that you  
17 would look for a condensed version of our risk  
18 discussion?

19 CHAIRMAN WALLIS: I would think we would  
20 need that, yes. We need a very brief overview to  
21 remind the committee of what is involved with this  
22 EPU, in terms of changes in flow rates and so on.

23 MR. BENJAMIN: We will clearly articulate  
24 differences between Dresden and Quad Cities as well in  
25 the presentations. So we won't have to go over that

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1 again.

2 DR. SCHROCK: I would think it would save  
3 time.

4 MR. BENJAMIN: I think it will, yes.

5 DR. KRESS: I think you want to talk about  
6 your reasons for doing the transient test, because  
7 that will be a question of contention perhaps.

8 MR. BENJAMIN: Very good.

9 CHAIRMAN WALLIS: Do we need anything on  
10 stability?

11 MR. BENJAMIN: I had a chance to observe  
12 the Duane Arnold presentation, and we may have an  
13 opportunity with the full committee to go back over  
14 the power to flow chart one more time, and have a  
15 chance to articulate exactly how we operate in the  
16 higher power regions.

17 And in a very practical way I think show  
18 how we do that, and --

19 CHAIRMAN WALLIS: This is part of the  
20 overview?

21 MR. BENJAMIN: This would be part of an  
22 overview, and I would suggest that Tim could go back  
23 through that again with the full committee and do that  
24 rather efficiently. And I think that would be  
25 worthwhile as well.

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1 DR. FORD: As part of the materials  
2 degradation is concerned, I guess one bullet.

3 MR. BENJAMIN: No problem.

4 DR. FORD: I don't know if I am allowed to  
5 say anything. Am I?

6 DR. KRESS: Yes, you can say or talk about  
7 things like that.

8 CHAIRMAN WALLIS: Yes, you can.

9 DR. FORD: Well, I don't see any problems  
10 at all with that.

11 DR. KRESS: Well, it seems like they might  
12 want to discuss the FAC, because that is what will  
13 come up at the full committee.

14 DR. FORD: There is a whole range of  
15 things, such as the FAC, the flow induced vibration,  
16 and potential cracking of the core shroud. It seems  
17 to me that all of those issues were in fact being  
18 adequately managed. We all recognize that they are  
19 being adequately managed.

20 DR. KRESS: And I think that the committee  
21 would probably have a preconceived notion that  
22 extended power uprates only affects FAC.

23 MR. BENJAMIN: So could I suggest that we  
24 would have one slide that would cover that topic, and  
25 that would have the bounds around how we are managing

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1 our materials and draw those conclusions?

2 DR. FORD: Well, depending on what we hear  
3 from the staff, and they don't have any problems with  
4 that.

5 CHAIRMAN WALLIS: And for accuracy, you  
6 could have a summary slide for ATWS.

7 DR. SCHROCK: One thing that never came up  
8 in this meeting that I wondered about and that is the  
9 statement in the SERs that the task code has not had  
10 prior NRC approval, but it is under review.

11 MR. HAEGER: Dan, can you speak to that?

12 DR. SCHROCK: That ought to get clarified  
13 I would think.

14 MR. PAPPONE: This is Dan Pappone. The  
15 task code has been accepted for transient evaluations,  
16 and delta-CPR evaluations, and it is currently under  
17 review for the LOCA considerations, where we are using  
18 it and taking it one step further.

19 As far as transients, we are looking at  
20 whether or not when or if transition occurs, and in  
21 LOCA we are looking at when and where. But that is  
22 under review.

23 DR. SCHROCK: When I look at this table of  
24 computer codes used for EPU, for transient analysis,  
25 and ATWS, you have a number of codes, and it appears

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1 in both places.

2 MR. PAPPONE: Right.

3 DR. SCHROCK: It is a little hard to tell  
4 -- and also I think it is G.E. terminology. You have  
5 SAFER/GESTR, which is a cover name for amalgamations  
6 of these various codes; is that right?

7 MR. PAPPONE: That's right.

8 DR. SCHROCK: And I may be alone in not  
9 understanding how they go together to do what you are  
10 doing it with it, but maybe that is something that  
11 needs to be clarified.

12 DR. KRESS: It certainly would be nice to  
13 see that database that you referred to on the ODYN  
14 code that shows that you are still within the  
15 parameters that it has been validated at.

16 MR. BENJAMIN: Would you like us to submit  
17 that prior to the full committee, or would you like us  
18 to submit that at the committee?

19 DR. KRESS: At the full committee would be  
20 fine.

21 MR. BENJAMIN: Okay. That's fine.

22 CHAIRMAN WALLIS: On the piping and  
23 reactor internals, I don't think you need to spend  
24 very much time. I think you do have to address the  
25 fluence issue, because they expect it to go up and it

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1 went down, or it appeared to go down.

2 DR. FORD: I think that comes under  
3 materials degradation.

4 CHAIRMAN WALLIS: Well, we don't need to  
5 go into a lot of the --

6 MR. BENJAMIN: That would be an  
7 approximately one slide treatment as you suggested,  
8 yes, and we would pick that up in there.

9 CHAIRMAN WALLIS: If there is nothing  
10 else, we will recess until tomorrow at 8:30 a.m., and  
11 we will then hear from the staff.

12 (Whereupon, the meeting was adjourned at  
13 5:38 p.m, to convene at 8:30 a.m. on Friday, October  
14 26, 2001.)

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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

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and, thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings.



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