Official Transcript of Proceedings ACRST-3170

NUCLEAR REGULATORY COMMISSION

ORIGINAL

Title: Advisory Committee on Reactor Safeguards Thermal-Hydraulic Phenomena Subcommittee Duane Arnold Energy Center Power Uprate Request

PROCESS USING ADAMS
TEMPLATE: ACRS/ACNW-005

Docket Number: (not applicable)

Location: Rockville, Maryland

Date: Thursday, September 27, 2001

Work Order No.: NRC-033

Pages 178-327

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

ACRS Office Copy - Retain for the Life of the Committee

TR04

DISCLAIMER

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

September 27, 2001

The contents of this transcript of the proceedings of the United States Nuclear Regulatory Commission's Advisory Committee on Reactor Safeguards, as reported herein, is a record of the discussions recorded at the meeting held on the above date.

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

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

+ + + + +

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

THERMAL-HYDRAULIC PHENOMENA SUBCOMMITTEE MEETING

DUANE ARNOLD ENERGY CENTER POWER UPRATE REQUEST

+ + + + +

THURSDAY

SEPTEMBER 27, 2001

+ + + + +

ROCKVILLE, MARYLAND

+ + + + +

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

COMMITTEE MEMBERS PRESENT:

DR. GRAHAM WALLIS, Chairman

DR. F. PETER FORD, Member

DR. THOMAS S. KRESS, Member

DR. DANA POWERS, ACRS Cognizant Member

DR. VIRGIL SCHROCK, ACRS Consultant

ACRS STAFF PRESENT:

PAUL A. BOEHNERT, ACRS Staff Engineer

I-N-D-E-X

AGENDA ITEM	PAGE
Introduction and Open Questions	181
NRR Presentations	191
Open Issues	283
Concluding Remarks of Subcommittee	306

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

(1:00 p.m.)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

MR. WU: No.

CHAIRMAN WALLIS: So the thermal being 12-

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

MR. WU: Right.

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

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

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

MR. WU: Yes.

CHAIRMAN WALLIS: Thank you.

MR. WU: And confirmation of it.

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

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

DR. POWERS: That's right.

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

MR. HUEBSCH: The first thing is that there was a question -- oh, this is Steve Huebsch, NMC. There was a question about the five percent limit, I believe that was in the write-up.

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

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

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

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

So those were the two main factors that changed the rate of generation. Duane Arnold monitors oxygen content in order to keep the flammability limits, because with the nitrogen containment, the hydrogen needs an oxygen component to reach there.

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

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

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

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

And from a conservative nature, we looked at that, and what we know is that our monitors are -- they read conservatively high when the drywall or containment temperatures are above the heat trace temperatures.

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

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

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

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

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

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

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

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

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

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

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

CHAIRMAN WALLIS: I see. Okay.

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

MR. BROWNING: I think we understand what Duane Arnold did. We need to understand how the staff looked at that.

CHAIRMAN WALLIS: And why it is acceptable, yes.

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

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

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

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

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

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

I think that we want to present here today the basis for the draft safety evaluation, recognizing that there were formatting and wording errors, and matters left to resolve. But we felt that they were at least close to closure, and the staff is going to present their evaluation.

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

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

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

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

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

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

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

MR. CARUSO: I'm sorry?

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

MR. CARUSO: Grid stability?

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

DR. POWERS: Okay.

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

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

But I was reminded that the SAFER method application under SECE -- I think 472 was the number -- resulted in a 1600 degree limitation being imposed.

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

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

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

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

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

DR. SCHROCK: Okay. Perhaps I am the only on here that had this impression of the results as presented. Both in the meeting yesterday and in the previous meeting on this topic, there was discussion about the large range above the predicted peak clad temperatures which is available.

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

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

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

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

They do essentially two sets of

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

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

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

DR. KRESS: So that was the basis then?

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

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

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

MR. CARUSO: Right, and I understand that.

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

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

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

DR. SCHROCK: Yes, I think you have.

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

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

GE's newest fuel lines.

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

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

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

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

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

But that a research program has been

initiated to try to confirm that regulatory decision.

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

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

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

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

I am going to report that we found the process to be quite positive and useful, and we intend to continue to do it. We looked at the safety analyses, and the performance evaluations that were prepared by GE and by the licensee.

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

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

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

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

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

And then we send a team of 4 or 5 people out there, and they will say that I want to look at the design record files for the ATWS analysis for this plant.

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

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

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

CHAIRMAN WALLIS: Like a Ph.D. defense.

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

A lot of this is background about what the criteria are,. and in the standard review plan, Section 4.2, that talks about fuel system design criteria for AOOs, and I believe that the criteria is that during AOOs that 99.9 -- 99.9 and not 99.99 -- percent of the fuel will not undergo transition boiling.

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

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

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

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

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

DR. POWERS: The COBRA-G, yes.

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

DR. POWERS: Okay.

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

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

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

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

One thing that I would like to mention is that although these analyses were done for an equilibrium core, thermal limits are established or confirmed for every individual reload, because you don't have the equilibrium core starting from the first core.

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

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

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

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

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

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

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

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

DR. KRESS: The average has changed though?

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

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

MR. CARUSO: That's correct.

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

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

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

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

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

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

CHAIRMAN WALLIS: Okay.

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

MR. CARUSO: Let's see.

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

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

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

MR. CARUSO: I did?

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

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

MR. CARUSO: Oh, okay.

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

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

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

And during the course of the review, we discovered that GE had used some data that was generated by a code known as COBRA-G to be included a database for a correlation that is known as GESTR-14. I think it may have been known as GESTR-10 at the time.

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

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

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

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

So as I say in this slide, we believe that they are taking appropriate action. They have taken appropriate action, and we think that this issue is resolved for Duane Arnold.

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

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

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

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

MR. CARUSO: Well, I will leave it at that, and I will agree. I think in this case that GE and the licensee have been very cooperative. We have honest technical disagreements, and honest differences of opinion on this.

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

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

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

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

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

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

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

MR. CARUSO: That's correct.

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

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

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

And during the review the staff discovered an internal GE document which questioned whether the existing Divom curve was applicable or appropriate for plants. And this also applied to any plant that used GE14 fuel.

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

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

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

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

CHAIRMAN WALLIS: Okay.

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

GE has recommended that licensees use a

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

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

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

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

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

CHAIRMAN WALLIS: What is the basis of

this Divom curve?

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

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

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

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

CHAIRMAN WALLIS: So it is an entirely theoretical --

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

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

MR. POST: Yes. Yes, it has.

DR. POWERS: Were there others?

MR. POST: There were some KLL specific tests that we benchmarked, and there was another event in Cofrontaes (phonetic) that was an unplanned event that we benchmarked.

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

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

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

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

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

So this was part of the standard review, and we did not identify any particular operation of any of these systems that would call into question operation at the higher power level.

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

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

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

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

The license confirmed to us that it can actuate, and it can inject the required amount of boron into the system when called upon to do so. We believe that they have demonstrated that the SLC system would be able to inject the required amount of boron into the reactor vessel during an ATWS.

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

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

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

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

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

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

MR. CARUSO: That's correct.

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

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

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

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

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

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

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

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

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

How does the revised power profile that is being envisioned for Duane Arnold and the power uprate affect that strategy?

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

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

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

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

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

MR. POST: Sorry about that.

DR. POWERS: I got all the articles, but

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

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

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

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

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

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

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

MS. ABDULLAHI: I would also have Tony Ulses intervene as well.

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

Is that the question really that you are asking?

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

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

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

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

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

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

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

MR. POST: The mid-1980s.

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

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

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

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

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

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

DR. POWERS: Thank you.

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

DR. POWERS: Do the members have any additional questions they would like to ask about reactor fuels? If not, I think we can go on.

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

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

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

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

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

And mostly we have a steam flow increase.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

CHAIRMAN WALLIS: I guess my comment went to the consequences of these things failing, and you are telling us that the consequence that you worry about is the pieces go down the steam line?

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

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

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

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

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

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

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

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

MR. WU: Yes, they failed.

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

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

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

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

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

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

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

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

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

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

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

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

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

MR. KNECHT: Correct.

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

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

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

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

DR. FORD: If it was laying on top of the separator, it would just sit there?

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

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

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

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

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

And there is no data and we looked at the dynamics of a pressure drop -- and it is about 10 percent of the -- and so the flow increase 20 percent, and the vibration level increased 50 percent. So, that is 1.7 or about -- and so you can say that you can get some reasonable assurance --

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

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

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

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

I mean, flow induced vibrations, there are resonances and things that happen, and when you scale up this is based on some assumptions, and it is much more reassuring to say we have actually run this thing, and we have measured the vibrations under the conditions, and they are indeed small or some measure.

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

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

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

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

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

DR. FORD: Or whatever.

MR. WU: Yes, whatever, and GE has generic testing of up to 13 percent, or all the way up to 13 percent. So they are bounded by those.

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

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

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

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

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

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

CHAIRMAN WALLIS: Maybe this could be

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

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

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

MR. SHUAIBI: We could certainly do that.

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

CHAIRMAN WALLIS: That seems a simple question to answer.

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

DR. FORD: Yes.

MR. SHUAIBI: We will take that back.

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

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

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

MS. MOZAFARI: Okay.

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

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

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

MR. WU: The methodology that GE used is with respect to Appendix I in the ELTR-1. They said they followed Appendix I of ELTR-1, which we had approved before.

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

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

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

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

MR. WU: Yes.

DR. POWERS: And how the question is did you look specifically at what they had done for the feed water nozzles, and do you concur that the cumulative usage factor is less than one for that feed water nozzle.

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

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

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

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

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

DR. POWERS: Well, it's just that I find it remarkable that everything drops down, and for understandable reasons. And here is one case where it goes up, and it seems logical that it should be a substantial fatigue for the feed water nozzle.

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

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

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

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

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

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

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

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

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

I think we can progress on to the next topic.

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

MS. MOZAFARI: Right.

MR. CARPENTER: Good morning. My name is Gene Carpenter from the materials engineering branch, and I don't have any slides or overheads to give out today.

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

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

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

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

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

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

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

We are obviously looking at the chemistries, and as you may remember from your previous life prior to the ACRS, BWRs have some fairly stringent chemistry controls in place, and even more so today than they did even 10 years ago.

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

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

CHAIRMAN WALLIS: Are you speaking about vessel internals here?

MR. CARPENTER: Yes.

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

MR. CARPENTER: Right, which is outside

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

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

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

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

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

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

I have an opinion, but since I have a

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

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

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

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

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

DR. FORD: Okay. I am now hamstrung.

MR. CARPENTER: To rephrase your question then --

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

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

Those VIP documents did not take into

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

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

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

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

We are still in negotiations with with regard to BWR VIP regarding what if anything -- what additional inspections, if anything, should be performed by the licensees.

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

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

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

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

DR. FORD: Okay.

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

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

MR. CARPENTER: Which uneasy feeling is

that, sir?

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

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

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

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

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

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

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

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

CHAIRMAN WALLIS: Okay.

DR. POWERS: We will resume at 10:30

(Whereupon, at 10:17 a.m. the meeting was recessed and resumed at 10:33 a.m.)

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

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

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

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

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

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

CHAIRMAN WALLIS: Yes, it does.

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

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

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

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

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

The licensee evaluated this change, and came to the conclusion in general that the effect is very, very minimal. The highest effect would be on the feed line, and on the main steam line, and those changes are going to be taken care of by modifying the core input in the code, so that it would predict the rate at which erosion/corrosion takes place.

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

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

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

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

MR. PARCZEWSKI: The comparison?

CHAIRMAN WALLIS: Yes.

MR. PARCZEWSKI: I looked at them briefly.

CHAIRMAN WALLIS: But you saw them?

MR. PARCZEWSKI: Yes.

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

MR. PARCZEWSKI: Yes.

CHAIRMAN WALLIS: Have you seen data from other plants which reassures that extrapolating the CHECWORKS code is valid?

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

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

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

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

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

CHAIRMAN WALLIS: How much scatter is

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

MR. PARCZEWSKI: Excuse me?

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

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

CHAIRMAN WALLIS: Typically how much?

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

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

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

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

MR. PARCZEWSKI: I'm sorry?

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

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

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

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

CHAIRMAN WALLIS: But does CHECWORKS predict the upper bound?

MR. PARCZEWSKI: I beg your pardon?

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

MR. PARCZEWSKI: The means.

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

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

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

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

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

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

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

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

CHAIRMAN WALLIS: That doesn't answer the question.

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

MR. PARCZEWSKI: No, it has to be calibrated. Usually, you know, you take at least two measurements, two sets of measurements, and you add up to the code to calibrate so to speak.

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

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

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

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

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

Now, what will happen with what we have

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

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

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

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

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

CHAIRMAN WALLIS: The other question if

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

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

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

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

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

And the question we are asking is how much investigation does the staff do for the application of this methodology for this particular application, and how did they do it? And we are having challenges understanding that.

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

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

MS. MOZAFARI: Right.

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

MS. MOZAFARI: Okay.

CHAIRMAN WALLIS: This is a generic problem.

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

MS. MOZAFARI: Right.

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

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

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

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

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

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

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

Are there criteria used to change your inspection interval or keep it? How is your inspection interval decided in the first place?

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

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

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

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

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

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

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

MR. SEVERSON: Yes, within what the model bounds are.

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

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

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

And then it says that the staff finds the response acceptable. We get this all the time, and then when we start digging into it, we get into this kind of a situation, and we have got to do something about that.

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

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

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

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

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

Monticello.

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

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

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

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

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

MS. MOZAFARI: Okay.

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

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

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

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

CHAIRMAN WALLIS: How do you assess PRA quality?

MR. HARRISON: It becomes a number of different factors that are involved. Basically, you are asking a question of does the plant models used in the PRA represent the plant that is operating, and in this case the plant that is going to be operating at extended power uprate.

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

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

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

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

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

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

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

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

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

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

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

MR. TREHAN: This is Nedra Trehan, Electrical Engineering Branch. We do look at stability, not in detail, but that stability should be maintained -- with the largest unit on the grid, of the nuclear power plant unit, or the most critical transmission line.

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

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

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

DR. POWERS: No matter what it comes --

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

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

And that same logic applies to component reliability. We don't expect any changes in failure rates, and there are monitoring programs, and maintenance rules, and other types programs, that are used to either maintain or to track the failure rates.

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

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

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

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

The one area that we did see where there were impacts were in operator response times. As indicated yesterday, there were five operator actions that were identified as potentially having raw values of greater than 1.06, which meant that they could have a 10 to the minus 6 impact on CDF if they were assumed to be filled.

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

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

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

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

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

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

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

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

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

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

They were simply looking at the comparison of the temperatures, and when the temperature got close to the byte line, they initiated SLC.

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

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

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

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

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

And the licensee also went back and

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

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

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

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

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

On external events, like I said, other than seismic and fires, other external events were screened out through the EPRI process. There is no direct impacts of the power uprate on earthquakes and fires.

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

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

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

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

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

And I don't think you would be able to get a good number one way or the other on what that would be as a result. I think conceptually that you are right. You could increase the fire.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

was acceptable for its use in this application.
And the last slide just provides a summary that walks through each of those areas that we have just discussed, and presents just a little bit of results.

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

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

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

MR. HARRISON: Right.

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

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

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

MR. HARRISON: That's true. I will change my slide for next time. And that is the presentation of the PRA. I would be glad to answer any questions.

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

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

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

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

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

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

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

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

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

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

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

MS. MOZAFARI: You are happy with that

DR. POWERS: Well, I got the answer.

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

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

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

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

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

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

MS. KAVANAUGH: I am Kerry Kavanaugh of the staff. As you heard yesterday, it is the licensee's position that their licensing basis for the use of containment overpressure is based on margin, which is 2.7 psig.

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

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

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

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

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

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

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

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

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

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

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

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

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

CHAIRMAN WALLIS: Is time the problem then?

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

However, there is a handful of plants with specifically boilers that cannot meet this requirement, and they were licensed not meeting the safety guide originally and we were aware of this.

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

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

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

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

Some plants need higher amounts of overpressure and some don't. For Duane Arnold, because they are going up to 209 degrees, I believe is your peak pool temperature, they are going to need approximately 5.8 psig, and I don't remember for what the time period was, versus two before the EPU.

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

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

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

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

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

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

MS. KAVANAUGH: Well, I don't believe

there has been a criteria for turning them down.

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

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

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

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

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

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

CHAIRMAN WALLIS: Well, isn't there then perhaps a power uprate level where you would stop giving them what they need? If they wanted a 25 percent power uprate, and then this would give you a suppression pool temperature of 215 or something -- I mean, there must be some point where you say you can't have what you need.

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

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

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

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

CHAIRMAN WALLIS: So there is no speed limit?

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

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

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

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

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

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

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

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

MS. KAVANAUGH: I'm sorry?

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

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

MR. RUBIN: If you mean a single failure, or a single active component failure that would result in increased head requirements, I'm sure that is in the analysis.

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

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

MS. KAVANAUGH: Okay.

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

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

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

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

And they use that as a basis to show now much containment pressure they have available. They don't use all that containment pressure.

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

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

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

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

MS. KAVANAUGH: For the containment.

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

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

When we originally licensed these plants, credit was given for overpressure for MPSH because of the physical fact that it was running and intact, and the coolant loses its density because of its elevated temperature if there was going to be containment overpressure.

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

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

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

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

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

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

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

CHAIRMAN WALLIS: There is no tomorrow.

MS. KAVANAUGH: Oh, okay.

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

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

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

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

DR. POWERS: Any other questions?

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

MS. KAVANAUGH: That is a good point.

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

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

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

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

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

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

DR. POWERS: Thank you.

MS. MOZAFARI: By way of concluding, I

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

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

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

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

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

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

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

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

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

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

CHAIRMAN WALLIS: And that the oxygen

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

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

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

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

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

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

MR. PERALTA: Yes.

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

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

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

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

CHAIRMAN WALLIS: To monitoring hydrogen?

MR. PERALTA: Yes.

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

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

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

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

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

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

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

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

DR. KRESS: It is really 3 percent.

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

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

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

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

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

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

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

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

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

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

CHAIRMAN WALLIS: So this is acceptable because the staff accepts that the operators will still take the right actions because they will know to not misunderstand these faulty readings. Is that the way the staff resolves it? That wasn't the explanation that we got first.

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

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

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

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

DR. KRESS: Yes.

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

Now, what is the procedure then? Do we

actually have to look at the final SER?

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

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

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

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

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

MR. SHUAIBI: I guess that question is to the ACRS, but what I would offer is if we can provide you written responses to those questions that you have, and provide you an explanation of our review process at the full committee. We would rather do it that way, but obviously it is up to you.

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

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

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

DR. KRESS: I agree with what you say,

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

DR. POWERS: It is.

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

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

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

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

There are some subtleties to it that I don't really fully understand that we could go into, but I thought it would be better to go into those compliance issues with the staff.

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

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

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

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

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

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

DR. KRESS: I think the view graphs that show what led to the bottom line results have a few of them, but mostly human error is based on the human error changes, and is based on the timing. I think those would also be appropriate to have in there, because that is the whole basis for the changes.

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

DR. POWERS: So what you are basically saying is that you would like to see a summary of everything that was presented?

DR. KRESS: Well, no. They went through a great deal of trouble to answer all the ACRS questions that we put to them ahead of time. I don't really think we need to go through those again.

I think they just give the slides to them or something, and let the rest of the committee read them. But I don't see how we can avoid going through the compliance part of it.

DR. POWERS: I wasn't going to avoid that. I was going to go through that with the staff.

DR. KRESS: Oh. Well, that may be, but I don't know if the full committee will be pleased with just saying that they did all the calculations using approved codes and met the limits.

DR. POWERS: Well, I think we have to give them something fairly specific. I don't think we can say give us a summary and then come back and say, well, that wasn't enough detail. That just is not playing fair.

So let's talk through the topics that were presented and say do we want to hear about that or not.

DR. KRESS: Okay.

DR. POWERS: Okay. They have compliance with regulatory requirements, and they have hardware modifications, analyses performed, and impact on plant margins.

DR. KRESS: I think I want to hear those and the whole basis of that.

CHAIRMAN WALLIS: That is the whole basis for the decision.

DR. POWERS: If they are going to go through it, then we are going to hear it again from the staff. That's the thing that I was trying to avoid.

CHAIRMAN WALLIS: Well, they went through that fairly briefly.

DR. POWERS: All right. We have plant operator training, stability monitor/instability avoidance.

DR. KRESS: I think I can do without both those.

CHAIRMAN WALLIS: What we really need to do is the stability if you want to show anything at all. There is orange curves and that you can actually get up past them, and things --

DR. KRESS: Yes.

DR. POWERS: Okay. So we want to go through that. ATWS event response for uprate conditions.

CHAIRMAN WALLIS: I am tempted to ask the staff why they accepted the ATWS response, but that may take a long time.

DR. POWERS: You are going to get that opportunity.

CHAIRMAN WALLIS: We don't need to go through all the details of that.

DR. POWERS: Well, I think it is do they go into it or not. There is nothing detailed in the 45 minutes that I am going to give them. I mean, we have got an hour-and-a-half.

CHAIRMAN WALLIS: Well, I think we have to have something about ATWS, because ATWS is going to turn out to be the power influences to the PRA later on isn't it? So I think you have to say something to that before --

DR. POWERS: Graham, I understand what the problem is, but they have got 45 minutes, and so that means they get 23 minutes to talk. That means that they get one view graph on each one of these topics, or we yell at the planning and procedures, because they have only give us an hour-and-a-half here.

DR. KRESS: I think that is where the problem is.

CHAIRMAN WALLIS: Well, I think you have to say that ATWS was handled in the standard way, and what has changed here is that the operators have to respond quicker. That's what they have to say. Can't they say that quickly?

DR. POWERS: No, because someone like you will ask them something that they don't feel obligated to answer.

CHAIRMAN WALLIS: It won't be me, but I know who it might be.

DR. POWERS: But there are committee members who have been known to ask questions at least as detailed as yours. Okay. Is there any topic on here that they don't need to go into?

DR. FORD: You could argue that materials degradation -- if you are talking about the time available, materials degradation issues, I have got my own opinion as to how important they are or not.

And I have put myself in the position of your technically informed person out in the public, and how they would react to presentations given today, in terms of the amount of quantitative data from the assessment on material degradation issues. Dana, I don't know if those minutia should be covered in the full committee meeting. I would suspect not, but I would hate to see our recommendations not taken account of.

DR. POWERS: We will get to draft a letter and provide the committee with a summary. I can't imagine your esteemed colleague from Oregon sitting quietly and having been drugged through the details of ATWS response not getting at least a chance to hear the word CHECWORKS.

So if you are going to go into this detail, we are going to do it twice; once with the licensee and once with the staff, and we had better cover them all.

I would hope they would not have to go through the discussion with the dryers and the separators. They are not safety issues, and nothing emerged out of this that suggests that that would change. But that is the only one so far that I have been able to take off this list.

I mean, what you are saying is that you would like to see a compact version of this, the presentation that they prepared for us yesterday afternoon.

DR. FORD: Apart from the dryers and separators, which I agree with you, the safety issue is the question of the quantitative treatment of the VIP vibration criteria for stress corrosion and cracking.

The details of the FIV, which I personally don't believe is a big problem, but as presented, somebody could turn around and say it is not adequately supported in the information given. And the other one is the one that you brought up, the CUF factors, and why are some up and some down. What is the rationale.

I personally don't think that these are big deals. But to someone outside this room, you don't see any evidence that they are a big deal. Do you understand my point? In what venue do you sort these things out and do you record preservation of those?

DR. POWERS: Right now I am only trying to give guidance to the licensee on what he is going to have to present. We have given him no help whatsoever because all we have said is that we want to hear four hours of presentation in 23 minutes.

And I don't think he is going to dance at his daughter's wedding over this one.

DR. FORD: I am quite willing to put my hand up and say don't mention it given the time, and I don't think there is any need to have a big discussion on materials degradation.

But I would hate to see it in the public environment, where this is not enough sufficient quantity for discussion.

DR. POWERS: Well, there are multiple things that go out on a public venue, and the staff evaluation report is a public document, and does go into this subject.

DR. FORD: But is it worthwhile for me just to write down my comments here and give them to the staff? Is that good enough?

DR. POWERS: There is another public document, and that is the ACRS letter, and I am not sure who it goes to right now. There are multiple avenues for bringing this up.

It appears to me that the recommendation of this subcommittee to the licensee on what he presents -- and understand that the licensee can use his own good judgment on what ought to be presented -- is that you attempt to go through the Items 1, 2, 3, and 4 in the agenda, and 5.

And I would suggest that in light of the time limitations that you not go into the PRA results. It is not part of their application. It is going to provoke a lot of discussion, and you haven't got time available to you to cover it in a way that you will find satisfactory the items that are being presented to you.

And Dr. Ford has suggested that you can limit the amount of discussion that you do on the corrosion substantially. I think the committee has been through CHECWORKS as an entity in some detail in the past, and those that have an interest in it have all been through it fairly in detail.

I think if you want to approach the subject, it is adequate to say that you looked at flow erosion using the CHECWORKS methodology, and let it go at that.

Otherwise, it sounds like most of these things they want to address.

MR. MCGEE: Could I review the list once?

DR. POWERS: You certainly can.

MR. MCGEE: This is Ron McGee. So you are requesting that we would cover next week during the 23 minutes allotted --

DR. POWERS: You will have 45 minutes and we usually count that in 45 minutes that we have had quite a cross-section of the committee here. So you might shade that a little bit, and take a little more time.

MR. MCGEE: Thank you. So, the plant modifications and then regulatory compliance, and the analysis performed, operator training, thermal-hydraulic stability, the ATWS response, fuel response for ATWS instability, and material degradation --

DR. POWERS: I think that you can handle that with one sentence there. If somebody else had a question, I think that can be pretty promptly handled because you are using fairly standard methodologies here, or that are familiar to the rest of the committee. There is nothing ground breaking in this.

MR. MCGEE: Okay. Our containment analysis.

CHAIRMAN WALLIS: I think you would have to show your justification for your MPSH. I think you have one summary curve that shows the containment pressure and the pressure required, et cetera. It has been an issue, and it is something that the staff has raised. So you have to make your case for that.

MR. MCGEE: We can skip the steam dryer and separators.

DR. POWERS: I think you can.

MR. MCGEE: ECCS analyses.

CHAIRMAN WALLIS: That's the bottom line. I think you need to have a bottom line; that of the 1300 and something degrees. You need to reassure that you will meet the criteria.

DR. POWERS: Yes, and I would approach that with a little caution, and make it clear that you have two limits, and why you have two limits, and why you comply with both of them, just because that is new. And you can go on to say that the second one may actually evaporate one of these days or something.

CHAIRMAN WALLIS: Now, why is he skipping PRA?

DR. KRESS: Don't have the time.

CHAIRMAN WALLIS: I think he has to show the PRA bottom line. I think you have to show the bottom line on any issue that is significant.

DR. POWERS: Graham, I know something about some of the members of the committee, and if we ask them to show a bottom line on the PRA, those members of the committee will say a bottom line isn't good enough for me.

CHAIRMAN WALLIS: Then we are going to need to have more time. This is the place where the licensee makes the case in a public forum that an uprate should be granted, and it has got to be a fair, comprehensive case. It doesn't have to be detailed, but it has got to cover main arguments.

DR. POWERS: The PRA is not part of the case.

CHAIRMAN WALLIS: Well, it is a consideration, and I think the conclusions here are kind of similar.

DR. POWERS: I feel a responsibility to comply with what the planning and procedures have given me for time, and I am afraid that if just giving a bottom line on the PRA is --

CHAIRMAN WALLIS: It is going to be asked anyway. It's not going to be asked for anyway?

DR. POWERS: And that is the other thing. Remember, I came in here with a going in position of just doing the PRA.

CHAIRMAN WALLIS: And that's why I wondered why you flipped completely.

DR. POWERS: Because I can't ask them to

do everything in 23 minutes.

CHAIRMAN WALLIS: Then they need more time.

DR. POWERS: I could ask them to do everything if I gave them the whole morning. I would keep my PRA results in my pocket, and just hit them with the bottom line numbers on it. And if it is provocative, I will take the time out of Wallis' hide.

CHAIRMAN WALLIS: I have a topic that we can vote on in five minutes.

DR. POWERS: What did you say?

CHAIRMAN WALLIS: I am very happy to take some time out of my topic.

DR. POWERS: I think you have done -- I actually think you have done some innovative things with the PRA that would be of interest to the committee.

MR. MCGEE: The information that we provided yesterday, all the slides and stuff, will that be provided to the full committee prior to our meeting with them?

DR. POWERS: That would ordinarily not be the case. They could get it if they asked for it. But that would not ordinarily be the case that they would have it.

DR. KRESS: Quite often we have had people come in with a package like that and say we are not going to present this, but if you would like to read these, here is a group of slides that tells you.

DR. POWERS: And as I said, I think you have done some innovative things with your PRA that I wouldn't be stunned if you advertised it. I think you have done an evaluation and in screening your human performance issues using PRAs to identify things.

And I think what you did for screening of components that is in your PRA was an innovative act in your application. I would have enjoyed exploring with you just to see how you did it and whether it was useful, and whether you would ever do it again.

But I think you have time to perhaps discuss that with individual members if they ask questions, and you may be able to present the bottom line numbers and what not.

The trouble is that this committee -- the full ACRS committee, their eyes tear over and they put hands on their heart when the word PRA comes up, and they have more questions than most people would ever be able to generate answers.

And here we are focusing more on power uprate issues, which of course you are doing innovative things there, too. Now, I would like to come to the staff presentation at this meeting.

And I will begin again with my suggestion to the committee, and see if they will overrule me, just as efficaciously as they did with respect to the applicant.

It seems to me that opposing sets of questions for the subcommittee meeting, in the interest of efficiency, we may have sandbagged the staff a little bit. And that we need to give them more freedom to design their presentation.

And I would encourage them to design their presentation to dissuade the committee from writing a letter that begins, "With the ACRS unable to ascertain if the staff has done an adequate review of the Duane Arnold application for a power uprate. Our examination of the SER suggests the staff has asked perceptive, probing questions. Documentation of the resolution of these questions in the SER is quite limited has become the familiar pattern for SERs."

"Our discussions with the staff did not produce satisfactory amplification of the SER. Too often the staff appears to have accepted a methodology that has been proven in the past without showing that it has also done an adequate investigation into the application of the approved methods."

"After oral discussion with the staff, it is not apparent that the staff is adequately familiar with either the methods or the specific application."

I think that I would like the staff to make a presentation that forecloses writing that kind of a letter.

CHAIRMAN WALLIS: In 45 minutes.

DR. POWERS: In 45 minutes.

CHAIRMAN WALLIS: With questions.

DR. POWERS: With questions. I think the areas that the subcommittee has pursued in here give you some guidance to what we are looking for when we say have you done an adequate application or investigation on how it was applied to the specific issue here.

I think we are in general familiar with those approaches that the staff has accepted in the past, and it is really how they were applied that is at issue here.

And as I said, when I read the SER, I found -- my general impression in reading the SER were the questions that the staff was asking were the right questions. In fact, they were very good.

It's that their final resolution doesn't come through as clear and clarifying. I am giving you my personal viewpoint, and I will turn to the rest of the committee and see what they would like to hear from the staff.

DR. KRESS: Personally, I will bite off from what you said. That would have been my recommendation.

DR. POWERS: Professor Wallis, have you any guidance that would like to give the staff on their presentation?

CHAIRMAN WALLIS: Well, I think you have given them a challenge. I'm just wondering how they will respond to it. I guess I will just have to wait and see.

DR. POWERS: I remain confident that they can, because again I looked at the SER, and I looked at the kinds of questions that were being asked, and addressed, and I thought that they were perceptive and challenging questions.

CHAIRMAN WALLIS: The only thing that I worry about is the committee getting into some of the morass that we got into; is that when we start probing the rationale for the decisions, we have difficulty getting answers to the questions posed. I don't want that to happen with the full committee. The answer should be crisp and to the point and reassuring.

DR. POWERS: Professor Schrock, can you give us some help here?

DR. SCHROCK: Probably not. I have been concerned for a long time about this issue of the falling back on the fact that analyses are done in accordance with previous approvals, and frequently that gets in the way of communicating an understanding of what is done and how it is applied in the present situation. I think you have said that very well.

And I am glad to hear that challenge thrown up to the staff. I think that is something that needs to change and it needs very badly to change.

So apart from my strong feeling on that, I don't think I can give you a lot of guidance on how you are going to cope with your problem of getting all this information exchanged in this short period of time.

DR. POWERS: And Dr. Ford.

DR. FORD: I have four specific questions that you can pass on to the staff.

DR. POWERS: Oh.

DR. FORD: You are giving them a challenge, and I am giving them four specific questions to help them meet the challenge.

DR. POWERS: Very good. Do you want to share them with us?

DR. FORD: Well, we have already gone through it in the other meeting. It is the CDF situation and FIC, and FAC, and the corrosion/ erosion cracking. I can give them to you. I have gotten them written out.

DR. POWERS: Okay.

MR. SHUAIBI: Dr. Powers, can I ask a question?

DR. POWERS: Certainly.

MR. SHUAIBI: This is Mohammed Shuaibi of the staff again. Is it your perception that the entire safety evaluation is this way, or is it just inadequate in certain areas?

DR. POWERS: I did not in the course of the presentation find an area that we asked questions in that I thought was handled in a way that was reassuring. Well, I take that back. I found the answers to the NPSH margin questions by the section head were answered promptly and explicitly.

MS. KAVANAUGH: Thank you.

DR. POWERS: Now, the criterion question that Dr. Wallis asked still is more nebulous, but I don't know that you are responsible for that in this application. Okay. Any other comments that the members would like to make?

Have we given you -- I'm sure that we haven't given you enough, but would you like to hear me talk anymore?

MS. MOZAFARI: No, I think we have an idea. We will go back and revisit our conclusions, and our evaluations to make sure that we have been clear enough about the basis for the evaluations.

DR. POWERS: Feel free to interact with Mr. Boehnert, who will be in a position to pass on any clarifications that you might need.

MS. MOZAFARI: Okay.

DR. POWERS: With that, I will turn the meeting back to Professor Wallis.

CHAIRMAN WALLIS: I would like to thank the representatives from Duane Arnold and GE, and the staff, and my colleagues for their contributions to this meeting, and I will adjourn the meeting.

(Whereupon, the opening meeting was recessed at 12:20 p.m.)

CERTIFICATE

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of:

Name of Proceeding: ACRS Thermal Hydraulic Phenomena Subcommittee

Docket Number: (Not Applicable)

Location: Rockville, Maryland

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.

Paul Intravia
Official Reporter
Neal R. Gross & Co., Inc.