Official Transcript of Proceedings

NUCLEAR REGULATORY COMMISSION

Title: Advisory Committee on Reactor Safeguards Power Uprates Subcommittee: Open Session

Docket Number: (n/a)

Location: Rockville, Maryland

Date: Friday, February 24, 2012

Work Order No.: NRC-1467 Pages 1-58

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

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

+ + + + +

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

+ + + + +

POWER UPRATES SUBCOMMITTEE

+ + + + +

OPEN SESSION

+ + + + +

FRIDAY

FEBRUARY 24, 2012

+ + + + +

ROCKVILLE, MARYLAND

+ + + + +

The Subcommittee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B3, 11545 Rockville Pike, at 8:30 a.m., William J. Shack, Chairman, presiding.

COMMITTEE MEMBERS PRESENT:

WILLIAM J. SHACK, Chairman

J. SAM ARMIJO, Member

SANJOY BANERJEE, Member

CHARLES H. BROWN, JR., Member

JOY REMPE, Member*

STEPHEN P. SCHULTZ, Member

JOHN D. SIEBER, Member

GORDON R. SKILLMAN, Member

ACRS CONSULTANT:

GRAHAM WALLIS

NRC STAFF PRESENT:

WEIDONG WANG, Designated Federal Official

PAUL CLIFFORD, NRR

ALLEN G. HOWE, NRR/DORL

JASON C. PAIGE, NRR/DORL

BENJAMIN PARKS, NRR

ANTHONY ULSES, NRR/DSS

SHIH-LIANG WU, NRR

ALSO PRESENT:

LIZ ABBOTT, FPL

MARK AVERETT, FPL

PAUL BANASZAK, FPL

CESARE FREPOLI, Westinghouse

RUDY GIL, FPL

PAUL KERSTING, Westinghouse

MIKE KILEY, FPL

ED MONAHAN, Westinghouse

CARL O'FARRILL, FPL

TOM RODACK, Westinghouse

SAM SHAFER, FPL

PHILIP TIEMAHN, FPL

MIKE WATSON, Westinghouse

*Participating via telephone

TABLE OF CONTENTS

P R O C E E D I N G S

(8:30 a.m.)

CHAIR SHACK: The meeting will now come to order. This is a meeting of the Power Uprates Subcommittee, a standing subcommittee of the Advisory Committee on Reactor Safeguards.

I'm Bill Shack, Chairman of the Subcommittee. ACRS members in attendance are Jack Sieber, Sanjoy Banerjee, Steve Schultz, Dick Skillman, Sam Armijo, Charles Brown, and our consultant, Graham Wallis.

Also joining us on the phone is Member Joy Rempe, who will be, as soon a she beeps on the phone, will be connected to us. Weidong Wang of the ACRS staff is the Designated Federal Official for this meeting.

In this meeting, the Subcommittee will review Turkey Point Power Units 3 and 4 License Request for Extended Power Uprate. We will hear presentations from the NRC staff and the representatives from the Applicant, Florida Power and Light Company.

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

agenda items on thermal conductivity degradation and fuel system design, the presentations will be closed in order to discuss information that is proprietary to the Applicants and its contractors pursuant to 5 USC 52(b)(c)(4).

Okay, so this portion of the meeting dealing with such information will be limited to the NRC staff and its consultants, Florida Power and Light Company, and those individuals and organizations who have entered into an appropriate confidentiality agreement with them. Consequently, we will need to confirm that we have only eligible observers and participants in the room for the closed portion.

The Subcommittee will gather information, analyze relevant issues and facts, and formulate proposed positions and actions as appropriate for deliberation by the full Committee. The rules for participation in today's meeting have been announced as part of the notice of this meeting previously published in the Federal Register.

A transcript of the meeting is being kept and will be made available as stated in the Federal Register notice. Therefore, we request that participants in this meeting use the microphones located throughout the meeting room when addressing

the Subcommittee. The participants should first identify themselves and speak with sufficient clarity and volume so they may be readily heard.

We will now proceed with the meeting, and I assume, Mr. Howe, you will start us off.

MR. HOWE: Yes. Thank you. Good morning. I'm Allen Howe, the Deputy Division Director in the Division of Operating Reactor Licensing in the Office of Nuclear Reactor Regulation. We appreciate the opportunity to brief the ACRS Power Uprates Subcommittee this morning on the Turkey Point extended power upgrade application.

Last December, on the 14th and followed up with a meeting on the 19th, we briefed the Subcommittee and then the full Committee on this topic. As a result of several remaining open items at the conclusion of the full Committee meeting in January, specifically the thermal conductivity degradation issue, the ACRS members requested that the staff rebrief the Subcommittee.

In preparation for today's meeting, the staff worked diligently, and we resolved the open items. Jason Page will walk is through an overview of the open items during his presentation in a few moments.

Also today the licensee will address the open items and questions from the application, and the NRC as part of their staff presentation will focus our discussions on the thermal conductivity degradation, the fuel system design, and grid crush issues. The staff will also be available today to answer any questions that you might have.

Staff's review has been very thorough. I'm very pleased with it. During the course of the review, including the recent events to address the thermal conductivity degradation and other emerging issues, the staff had frequent communications with the licensee, including conference calls, letters, requests for information and audits, as well as public meetings. We believe this dialogue has contributed positively to our overall review.

Just one other note I want to make to the Committee before I turn it over to Jason is just more broadly on the thermal conductivity degradation issue. We issued requests for additional information pursuant to 10 CFR 50.54(f) to 11 nuclear power units that use the Westinghouse-furnished realistic emergency core cooling system evaluation models. We did that on the 16th of February.

These 11 units currently have reported

peak cladding temperatures above 2,000 degrees Fahrenheit. The letters requested the licensees provide an estimate of the effect of thermal conductivity degradation error on the peak cladding temperatures and also the methodology and the assumptions used to determine the estimates.

The licensees have until March 19 to provide their response to this request, and the reason we did that, again, was to gather additional information to understand where they were relative to the regulatory limit of 2,200 degrees, factoring in the thermal conductivity error.

At this point, I'll turn over the meeting to our project manager on the Turkey Point extended power uprate, Jason Paige.

MEMBER SIEBER: Could I ask a question? Is the thermal conductivity problem unique to the ASTRUM code?

MR. HOWE: I'll give you a short answer. I think we have folks here from Reactor Systems. It is applicable to ASTRUM, but it's also applicable to other methodologies that Westinghouse has used, so some of the 11 I believe are units that do not use ASTRUM.

MEMBER SIEBER: That's correct.

MR. HOWE: They use a different methodology.

MEMBER SIEBER: And this has existed since when, time immemorial?

MR. HOWE: We identified the issue and put out an Information Notice in 2009 when we first identified the issue, and then it took a period of time and additional analysis to get a more refined picture of it. We issued another Information Notice last December.

MEMBER SIEBER: So one could say that this is defect in analytical methods that's existed for many years?

MR. HOWE: I'm going to have to turn to one of the folks who is a little bit closer to it. Tony, can you talk about that?

MR. ULSES: Yes, I'm Tony Ulses. I'm the Branch Chief of Reactor Systems. Actually, I apologize. Could you repeat your question? I'm sorry. I don't remember exactly.

MEMBER SIEBER: The question is even though this is recently identified, 2009, I presume that since ASTRUM was built on previous codes that the issue of bad estimates or incorrect estimates of thermal conductivity at relatively high burnups has

existed for long periods of time, years?

MR. ULSES: The short answer is yes. This is not a new phenomenon. What is new is an understanding of the impact of actually addressing it as you work it through the entire evaluation model. That's information that we did not have until December of last year.

MEMBER SIEBER: Okay, and are you going to cover this in more detail today?

MR. ULSES: We have a discussion on this when we get into the proprietary session, yes sir.

MEMBER SIEBER: Okay.

CHAIR SHACK: Just a quick question. I mean, I assume you picked best estimate codes because they have less inherent conservatism, so they might be more effective. How about other people's best estimate codes? Are none of them above 2,000?

MR. ULSES: Well, we've looked at the other vendors, and the other vendors have taken action to address this in their own unique ways.

MEMBER ARMIJO: So, in the BWRs, you know, they don't get to such high peak temperatures, but do the same effect exist in the other vendors' codes?

MR. ULSES: Well, the short answer, again, the vendor -- the other vendors have taken action to

address this in their codes and to speak specifically about BWRs. There are no best estimate methods being used currently by the BWR fleet.

MEMBER ARMIJO: Okay.

MR. ULSES: So what we were talking about earlier about the Appendix K type of approach really applies to that discussion.

MEMBER ARMIJO: Okay. Thank you.

MEMBER SIEBER: I presume, too, that BWRs, to my knowledge, operate at lower peak temperatures than PWRs. It's more margin building.

MEMBER BANERJEE: Is this problem sort of highlighted because of high burnups? It's sort of like, what five to seven percent degradation for every ten megawatt days per ton or something -- or gigawatts, yes.

MR. ULSES: Well, I can't quote the actual magnitude off the top of my head, Dr. Banerjee, but essentially the issue is unique to high burnup fuel phenomenon and how the cores are operated now relative to, say, how they were operated 15, 20 years ago.

MEMBER SIEBER: So 30 years ago a discharge burnup, average for a discharge burnup was about 33,000 --

MR. ULSES: It was much lower, yes.

MEMBER SIEBER: -- megawatt-days per ton. I've seen numbers in the 58,000 now for some assemblies which does make an impact.

MR. ULSES: That's true.

MEMBER BANERJEE: So you're going to speak in some detail about the phenomenon at some point? All right.

MR. ULSES: I'm not sure exactly what we have in our proprietary session. It was early. We can look at the slides. We have discussion about it. We can answer questions when we get there.

CHAIR SHACK: We need to be in the proprietary session before I think we ask too many questions.

MEMBER BANERJEE: Yes, so let's --

CHAIR SHACK: Let's move on.

DR. WALLIS: Can I ask a question, since we talked about history and said this was recently discovered? We were supplied with a letter from Sam Collins in 2002, which said that use of PAD 4.0 TCD was a licensing condition for this plant, so it looks as if TCD was an issue in 2002.

MR. HOWE: Okay, I'm not familiar with that letter, so it's --

MEMBER BANERJEE: Yes, it's in the

material we got.

DR. WALLIS: It puzzled me when I heard that. If it's an issue ten years old, you'd think it would have been resolved long ago.

MEMBER BANERJEE: It was identified in 1996 in the paper that we got from Halden.

MEMBER SIEBER: Right. That's where the new insights came from.

CHAIR SHACK: Yes, I mean, there is an Information Notice, but it's December where they sort of really flagged it as sort of having the estimate of the magnitude of the impact, I guess, that it had.

DR. WALLIS: But it puzzled me why this was a licensing condition ten years ago. There seemed to be all these RAIs, which start off with use of the old version of PAD 4.0 without TCD. This has just puzzled me. I don't know if you have an answer to it.

MR. HOWE: At this moment, no.

DR. WALLIS: Okay.

MR. ULSES: Yes, I'm not directly familiar with the letter that you're referring to, Dr. Wallis. It's something that we can look into it. You know, as I said earlier, though, the issue really manifested itself when we saw the impact as it was washed effectively through the entire evaluation model from

looking at the actual field performance code and then looking at the actual figure of merit, which in this case is PCT. We've never seen that entire analytical stream work through with the correction for the error until last year, December.

MR. PAIGE: Good morning. My name is Jason page. I'm the project manager in the Office of NRR assigned to Turkey Point. First, I'd like to take this opportunity to thank the ACRS members for your effort in reviewing the proposed EPU application and revised safety evaluation with such a short turnaround.

I also want to express my thanks to the NRC staff for conducting a thorough review of a very complex application and also for providing support to these meetings. During today's Subcommittee meeting you will hear from both the licensee and the NRC staff in providing you with the details of the EPU application.

The objective is to provide additional follow-up information relating to the details of the Turkey Point EPU application and provide the staff's actions to resolve the open items generated during and after the ACRS Subcommittee meeting on December 14, 2011.

Before I cover the resolved open items and agenda for today's meeting, I would like to provide some background information related to the proposed EPU. On October 21, 2010, the licensee submitted its license amendment request for Turkey Point Units 3 and 4 EPU.

The proposed amendment will increase each unit's license core power level from 2,300 megawatt thermal to 2,644 megawatt thermal. This represents a net increase in license core thermal power of 15 percent, including a 13 percent power uprate and a 1.7 percent measurement uncertainty recapture. This is a 20 percent increase from the original license thermal power.

The staff's method of review was based on RS-001, which is NRC's review plan for EPUs. As you know, it provides a safety evaluation template, as well as matrices that cover the multiple technical areas that the staff is to review.

There are no associated linked or -- there are no associated or linked licensing actions associated with the EPU application. FPL previously submitted two license amendments for Turkey Point, the AST amendment in 2009 and the spent fuel criticality analysis amendment in 2010. The NRC staff approved

the AST and spent fuel pool criticality analysis amendments in June 23 -- on June 23 and October 31, 2011, respectively.

Finally, there were numerous supplements to the application responding to multiple staff REIs. Overall, there were approximately 50 supplemental responses which supported our draft safety evaluation. Also, the staff completed several audits to complete its review and resolve open items.

As Allen mentioned, on December 14, 2011, and January 19, 2012, we briefed the ACRS Power Uprate Subcommittee and full Committee on this topic, but as a result of several items remaining open at the conclusion of the January 19, 2012 full Committee meeting, specifically the thermal connectivity degradation issue, the ACRS members requested that the staff rebrief the Subcommittee.

This slide shows all of the items that remained open after the conclusion of the January 19 full Committee meeting. All open items have been resolved by the staff, and, as requested, the staff provided all licensee supplements to address the open items to the ACRS staff. Also, the staff provided a revised safety evaluation to the ACRS staff on Tuesday, February 21, 2012, with a list of sections

that were revised to close out the open items.

This slide is the topics for today's discussion. The topics were determined from the action items or issues that remain open after the conclusion of the full Committee meeting.

First, the licensee will provide an introduction, which will include an overview of the proposed EPU and status of the review, and FPL will provide additional details and clarifying information on discussion topics from the ACRS full Committee meeting on January 19. The NRC staff will then present on the thermal connectivity degradation and fuel system design grid crush issues.

The staff is only presenting on these items, because these were the only open items that changed the technical evaluation of the SE or not considered as open items that only validated information in the safety evaluation provided to you last year in preparation of the ACRS Subcommittee on December 14, 2011.

Even though the other technical review areas are not being presented today, the staff is available to address any questions you might have. Lastly, the staff's thermal connectivity degradation presentation will be a closed session due to the --

due to there being proprietary information in the slides.

Unless there are any other questions, I'll turn it over to FPL, Mr. Mike Kiley. Mike is the Site Vice President for Turkey Point Units 3 and 4.

MR. KILEY: All right. Good morning. My name is Mike Kiley. As Jason said, I'm the Site Vice President at Turkey Point.

With me today to my immediate left is Mark, Mark Averett. He has not presented here previously at either the Subcommittee meeting or the full Committee meeting. He is the Manager of PRA for the fleet, and he'll be here to address any PSA questions that do come up, and he does have a section of the presentation.

To his left, Steve Hale, who you have seen before. Steve is the Director of EP Licensing, and to the far left, although he does not have a speaking role today, Sam Shafer, one of the Assistant Operations Managers and over 20 years of experience and a licensed SRO at the station.

First of all, I'd like to thank the ACRS Subcommittee for the opportunity to present the EPU license amendment request for Turkey Point here today. Since the ACRS Subcommittee meeting and the full

Committee meetings, we have worked very closely with the NRC staff to close the remaining open action items.

We recognize and appreciate the importance of the staff's questions, particularly those surrounding thermal connectivity degradation. The staff performed a detailed review of FPL's analysis, including a multi-day audit in which we presented our analysis to the staff.

This audit and other audits performed by the NRC resulted in a thorough and comprehensive review of the proposed EPU, so at this point I'd like to turn it over to Steve Hale, and we are open to any questions.

MR. HALE: Thanks, Mike. Next slide. First, as Jason mentioned, after the ACRS --

CHAIR SHACK: Just a second, Mr. Hale. Joy, can you hear us now? Maybe she's on mute. Okay. Her email says she can hear us, so move ahead.

MR. HALE: All right. Okay, as Jason mentioned, after the full Committee meeting we had four open items remaining, the new fuel storage area tech spec PCD, as we've already discussed, fuel seismic/LOCA loading, and we also had two I&C RAIs.

We have provided all of our responses to

the staff, and, as Jason mentioned, some open items have been closed in the SE, and the NRC staff did issue the revised SE this week.

CHAIR SHACK: Just a minute again. Joy, can you hear us now?

MEMBER REMPE: I can. Can you hear me?

CHAIR SHACK: Yes, I think you've got to back off from the phone a little bit.

MEMBER REMPE: Okay. I will turn the volume down. Is that better?

CHAIR SHACK: I think a little more.

MEMBER REMPE: I can put it on mute, too.

CHAIR SHACK: Speak very softly. Now you've gone.

MEMBER BROWN: She's on mute.

CHAIR SHACK: She's on mute. Okay.

MR. HALE: Why don't you back it up there, Sam? What we thought, at the full Committee meeting there were a number of questions related to loss of offsite power, ERA, so what we thought, the staff will be covering the open items, but we thought it would be worthwhile to brief the Subcommittee on some of those so that it's clear in everyone's mind, you know, what are the impacts of the EPU for these two events.

The first action, Dr. Skillman, right, you

had a question regarding --

MEMBER SKILLMAN: Mr. Skillman, yes, sir.

MR. HALE: Mister. I'm sorry.

MEMBER SKILLMAN: Steve, thank you.

MR. HALE: You had a question regarding the applying an uncertainty on pressure. We went with a lower pressure versus a higher pressure uncertainty, and intuitively you would think if you went with a higher pressure that you would get a worse result. I believe that was the genesis of the question.

MEMBER SKILLMAN: That is accurate, yes, sir.

MR. HALE: What we did is we went back and ran the case as you had requested, and, as expected, the reason the higher pressure case is more conservative -- is less conservative is you get a earlier reactor trip.

MEMBER SKILLMAN: Yes, sir.

MR. HALE: So that is the reason we go with the lower pressure, because it maximizes the pressure of the event.

MEMBER SKILLMAN: I understand your answer and accept it, and I thank you for doing that work.

MR. HALE: Okay.

MEMBER SKILLMAN: Thank you.

MR. HALE: Very good.

CHAIR SHACK: Just out of curiosity, I notice your current analysis has a margin of .1 psi. Now, that's really slicing it pretty thin.

MR. HALE: Yes.

CHAIR SHACK: What did you change in the input analysis to get the whopping 1.9 psi that you have now?

MR. HALE: Ed, do you want to speak to that? We have --

MR. MONAHAN: This is Ed Monahan from Westinghouse. What we did was we changed the pressurizer safety valve set pressures, the pressure at which they open. They had to reduce those in order to support the EPU.

MR. HALE: Okay. Moving on, we had quite a bit of discussion at the full Committee meeting on loss of offsite power. What we did as a result of that discussion is go back and look at the historical performance of the grid associated with Turkey Point.

We've actually only had one duel-unit LOOP, and that was as a result of Hurricane Andrew in August of 1992, but, of course, both units have been placed in a safe condition in anticipation of the onset of hurricane force winds. There have been

several single-unit LOOPs that were not grid-related but were generated, you know, either onsite or in the switch yard.

One event that is not listed here that I would mention, there was a grid disturbance in February of 2008, which resulted in a partial blackout in Florida. However, although both units tripped, the units did not lose offsite power during that event. We were actually fast-bus transferred to offsite power.

In looking at it from a PRA standpoint, the dual-unit LOOP frequency is a .02 per year, but when you look at it from a core damage frequency for a dual-unit LOOP it's in the order of 8×10^{-8} per year.

When we looked at the transient results, the criteria that we need to meet for a Cat 2 event is that we don't fill the pressurizer. In other words, you don't go water solid in a pressurizer event, and the results, because it's a fairly quick transient, are very comparable to our current licensing cases.

One point that we wanted to make very clear, because I think there was some confusion associated, we have not added any new operator actions as a result of the EPU in response to a LOOP. Any

other questions on that?

Okay, the next topic I thought would be worthwhile to just touch on a little bit, Turkey Point is somewhat unique. We do have some shared systems at the site, and, as Mark will get into, these shared systems really contribute to a relatively low core damage frequency. In other words, there are some benefits from a PRA standpoint.

As we discussed at the last meeting, for the emergency core cooling systems we do have four pumps for both units. These units start on an SI signal from either unit.

So, in other words, all four pumps start, but you have an SI at Unit 3 or Unit 4. Two are required for LOCA, and only one is required for other events, and each pump is aligned to an individual diesel generator, so it's four diesel generators, and the pumps are aligned to each individual EDG.

With regard to the auxiliary feedwater system, it is somewhat unique for Turkey Point, as well. We have three turbine-driven pumps for both units. One pump can satisfy the requirements of both units. So, in other words, we have the AFW function without any AC power available.

MEMBER BROWN: Is that simultaneously?

MR. HALE: Hmm?

MEMBER BROWN: Simultaneously?

MR. HALE: Yes.

MEMBER BROWN: Okay. I just want to make sure I understand.

MR. HALE: In addition to that, we also have a full capacity diesel-driven standby feedwater pump, although it's not, you know, not an aux feedwater pump. It is available for use. It has its own standby diesel, so the combination of that provides us --

DR. WALLIS: What's the capacity of this diesel pump?

MR. HALE: It's much greater than the AFW pump. It's used for a number of other functions, as well, but as you might imagine, that provides some fairly significant benefits from a PRA standpoint. Also, the EDGs, we've got two for each unit, and they all start with an SI signal from either unit.

Also, the EDGs can be cross-tied from the control room. This was a feature we installed in the late eighties which allows an -- under a station blackout scenario, you could actually power both units from a single diesel and maintain safe conditions.

MEMBER SKILLMAN: Steve, back to your

comment regarding can perform function without AC power, turbine-driven aux feedwater pumps are magic machines. They both consume heat and deliver coolant, but they do have a control system.

MR. HALE: Right.

MEMBER SKILLMAN: Is this a DC?

MR. HALE: Yes. Yes.

MEMBER SKILLMAN: NI 1, Class 1 type of system?

MR. HALE: Yes. Yes.

MEMBER SKILLMAN: Thank you.

CHAIR SHACK: I was curious, your reported PRA numbers are like a factor of 40 almost lower than they were when you had your license renewal SAMA stuff. Was all this equipment in place then, or is some of it newer? Is all that change due to essentially an analysis change?

MR. HALE: It's essentially an analysis change. This equipment has been in place for some time, and Mark will get into some details on the PRA and one of the reasons why, you know, Turkey Point's PRA is somewhat lower than the baseline.

DR. WALLIS: Somewhat lower.

MR. HALE: Yes.

MEMBER SCHULTZ: Steve, with respect to the DC power supply, what is the anticipated time of operation available for the DC power?

MR. SHAFER: This is Sam Shafer, Florida Power & Light. Right now, about 80 percent battery life will look good two hours. We do have bus load stripping to get down to the minimum essential equipment, which will give us a criteria for 80 percent capacity for a two-hour run.

MR. HALE: Okay, it there are no more questions with that, I'll turn it over to Mark, and he'll run through and provide some details on the Turkey Point probabilistic safety assessment.

MEMBER SKILLMAN: Steve, before you do that, let me ask a question. Forgive me for being new on the Committee, but since the last meeting or two I've been involved with this a question has arisen in my mind, and it might be one that's easily answered.

For this uprate, did you go back and recreate your utilization factor for cycles so that as you add the uprated power, as you look at all the conditions that are going to be introduced to this rather aged unit that you know your ASME Section III Class 1 analyses are accurate in terms of U, or utilization, thermal cycles?

MR. HALE: Yes. Yes.

MEMBER SKILLMAN: If I could ask, how did you do that, please?

MR. HALE: Well, you basically look at temperatures. At Turkey Point, our fatigue analysis is specifically related to Class 1 components, you know, steam generators.

We did an extensive view of fatigue and utilization factors for license renewal. We got into and we did a detailed review of TUFs. We also looked at our historical performance on transients and looked at a projection of our transients for 60 years.

Now, when you look at an EPU, you've got to look at the temperatures, and what you see is there's relatively minor changes in overall transient temperatures with regard to Class 1 components and fatigue, but we did address that, and, fortunately, as a result of license renewal we had updated all those analyses, so it was a fairly simple exercise to go back and look at the impact of the changes in temperature regarding EPU relative to that fatigue analysis.

MEMBER SKILLMAN: Thank you, Steve.

MR. HALE: Yes.

MEMBER SKILLMAN: Thank you.

MR. HALE: Go ahead, Mark.

MR. AVERETT: My name is Mark Averett. I'm a Lead PR Analyst for Turkey Point. You want to change the slide? Thank you.

Even though EPU is not formally a risk-conformed submittal, we risk-conformed it, anyway. The risk of the EPU was calculated using the Turkey Point duel unit internal events PRA model, and that was last updated in March 2010. The data is current through the end of 2006, and we quantified core damage frequency and large early release frequency.

What we used for internal flooding was the IPE screening analysis, because at the time that's the best we had. Next slide.

For external events analysis, we used the IPEEE for seismic; we were in a low-seismicity area. We were -- all we had was -- I wouldn't say all we had. IPEEE walkdowns were considered sufficient to address it, and that's what we used.

Internal fire events, we used the IPEEE screening analysis, which did contain component-capable mapping to fire zones, and we actually quantified core damage frequency for those with a 10^{-6} screening cutoff.

High winds, external floods,

transportation events also from the IPEEE. Those were pretty much looking at the initiating event frequencies and looking at -- doing a qualitative assessment looking at the design features in place to withstand the event.

For shut-down risk, we don't have a shut-down PRA like a lot of utilities. We address shut-down risk with a defense-inducted procedure based on NUMARC-9106 and implemented at the site.

Okay. For the actual internal events analysis, we did four things to modify the internal events PRA. We actually changed the logic models to reflect the physical changes that were being made for the EPU.

We did a human liability analysis update to reflect the EPU-related timing changes, which pretty much reduced some of the available times to the operator to recover or to perform actions that were modeled in the PRA.

There were some minor success criteria changes for the LOCAs, and offsite power recovery credit was revised to reflect EPU. Again, this related to the timing issues available to recover offsite power before, basically, it was too late.

CHAIR SHACK: Those LOCA success criteria,

you've got four categories of LOCA.

MR. AVERETT: Right.

CHAIR SHACK: You didn't change the criteria for the small-small. You changed it for the small, medium, and large. Then I looked, and as I expected, the frequencies for the medium and large went up.

MR. AVERETT: The core damage frequency?

CHAIR SHACK: The core damage frequency, and it went down for the small and the small-small. Now, I would have thought it would have -- because I have more restrictive success criteria, I expected to see them go up or be unchanged. I was puzzled why the small went down.

MR. AVERETT: The small LOCA went down?

CHAIR SHACK: The small LOCA went down, yes.

MR. AVERETT: I thought the success criteria changes were pretty much just limited to medium and large LOCA.

CHAIR SHACK: Well, it's --

MR. AVERETT: I thought they were --

CHAIR SHACK: It said that there was a minor -- you know, it's where you inject. It was coldleg injection --

MR. AVERETT: Right.

CHAIR SHACK: -- was what you had in previous, and you had to change that for the --

MR. AVERETT: I thought it was just for the medium and large break LOCAs, and it had to do with the number of lines you required, or it may have actually been for the high-head safety injection and recirculation, the number of pumps you needed.

CHAIR SHACK: Yes, it was high-end safety injection.

MR. AVERETT: I'm sorry, I don't remember these in excruciating detail, but --

CHAIR SHACK: Let's see.

MR. AVERETT: But you're right. I wouldn't have expected small LOCA to go down.

CHAIR SHACK: Down, yes, and it did, and I was just curious as to why that happened. Now, of course, I can't find that number. Oh, there it is.

MR. AVERETT: We actually reported the individual recording frequencies by initiating event.

CHAIR SHACK: By initiating event.

MR. AVERETT: We did, and the CDFs went down for small.

CHAIR SHACK: Yes, went from 8.7×10^{-8} to 7.1×10^{-8}, which just --

MR. AVERETT: Oh, you know what might have done that? If you go forward to Slide 19 -- sorry, maybe it's been -- go back one. Oh, see this changes to minimize risk increase? We changed the -- the first one wouldn't have had any effect. That's feed-and-bleed cooling. The second one might have had an effect --

CHAIR SHACK: The second one might have had an effect.

MR. AVERETT: -- because when you have an SI signal, and I don't know if you're familiar with this one, all the pumps come on. You have a small LOCA. The RHR pumps come on. The high-head safety injection pumps come on.

Well, the RHR pumps are just basically on recirc, and we need to shut those down within a certain amount of time. Otherwise, the water and the recirc lines get too hot, and we assume that they failed.

So, we moved the procedure step up to afford the operator more time to do that. Therefore, the probability of the operator failing to do that would go down, and so that could possibly explain the small break LOCA effect, and it was pretty minimal, I think.

CHAIR SHACK: Yes, it's small. It's just counterintuitive.

MR. AVERETT: Yes. Okay, where are we?

MEMBER SCHULTZ: Mark, I've got a question. You say the external events were assessed qualitatively, and Steve mentioned earlier that the dual-unit loss of offsite power frequency is .02 per year. Is that something that you've looked at recently? When was the last time you evaluated that dual-unit loss of offsite power?

MR. AVERETT: You mean evaluate or came up with the frequency?

MEMBER SCHULTZ: Came up with the frequency.

MR. AVERETT: That would be, I believe, on the previous slide. We had a data update that went through 2006, so the data update probably was done in late 2007, but so the offsite power date would be through 2006.

MEMBER SCHULTZ: And is that done looking at both the events that have occurred, dual-unit, single-unit, and also the types of external events that might cause dual-unit loss of offsite power?

MR. AVERETT: Well, the entire -- if you look at the industry data, as well as our data, and do

a Bayesian update of that data, for external events -- for external events, like are we talking about fire and high winds?

MEMBER SCHULTZ: High winds, yes, particularly.

MR. AVERETT: Yes, I guess the high winds would be -- yes, offsite power is kind of like an internal and an external event, so we do look at the -- from an internal event perspective, we include those losses of offsite power that are due to external events, as well. Is that what you're asking?

MEMBER SCHULTZ: Yes, because you just mentioned that it's assessed qualitatively for the external events, I wanted to understand the comprehensiveness of the evaluation of the dual-unit loss of offsite power.

MR. AVERETT: Well, external events such like the high winds and external floods, I guess you would look at --

MEMBER SCHULTZ: Sorry?

MR. AVERETT: I think those are more -- it's a fairly high-level look at it, looking at the initiating. For example, for external floods, of course, you're looking at what can breach the grade of the plant, and the conditional core damage probability

is pretty much assumed to be one once you do that, so really loss of offsite power doesn't play a role in external flooding.

So, for fire I think we assume a loss of offsite power, given a fire. For high winds, it's the same thing as external flooding, looking at the probability to get high winds to an extent that you start compromising the diesel generators, and we assume an offsite power, a loss of offsite power for that.

MEMBER SCHULTZ: Okay, Mark. Thank you.

MR. AVERETT: Okay. I think I've already -- we talked about external events, and IPEEE results were reviewed for EPU impact, and the impact was minimal. Shut-down risk, again, we addressed that through defense in depth approach. We don't have a shutdown PRA.

So I know that we have an administrative procedure called Admin-51, which implements this NUMARC-9106 guidelines in defense in depth, and those -- we are going to be looking at that and modifying it for APU impacts on color assignments, whether it's green, yellow, orange, or red.

DR. WALLIS: All these things are assessed qualitatively. How do you come up with a number?

MR. AVERETT: We don't.

DR. WALLIS: You don't?

MR. AVERETT: Defense in depth is the numbers associated with how many trains we --

DR. WALLIS: So how do you conclude anything?

MR. AVERETT: From qualitative assessment, the way you concluded stuff before PRA. You look at it and give your best engineering judgment you can.

DR. WALLIS: The effect is small, something like that?

MR. AVERETT: Yes.

DR. WALLIS: But you've got very small numbers, anyway, here.

MR. AVERETT: Well, yes. Some things we don't have a PRA for, though. Okay. Steve already covered a lot of this, but it does have a substantial effect on the PRA, and Mr. Shack, I believe you said that you noted the CDF is quite low, and I've had to defend that many times.

CHAIR SHACK: Yes, I was going to say it looks like an AP1000.

MR. AVERETT: But it is kind of a unique design. The first one I'd like to talk about is the offsite unit RWST injection capability. Steve talked

about the fact that you have -- say there are two units, Unit 3 and Unit 4. If you had a small LOCA on Unit 3, all four high-head safety injection pumps come on and discharge into a common header, okay, so we have two-unit, three pumps, two-unit, four pumps.

Unit 3 pumps take suction from the Unit 3 refueling water storage tank. Unit 4 pumps take suction from the Unit 4 refueling water storage tank. Once it's noted that the Unit 3 pumps are running quite well, the Unit 4 pumps are shut down, okay.

Now, in the course of the event, if you start having problems with the high-head safety injection or later on through recirculation problems, all the operator has to do, and he's procedurally directed to do this, is basically turn on the Unit 4 pumps, and he has another factor of two redundancy with a brand new, nice and full refueling water storage tank. I don't know of any other plant in the United States that has that.

Station blackout cross-ties, Steve told you about the fact that we have four high-capacity diesels, only one of which is actually necessary. We'd like to have more than one, but if you only have one, you could do a safe shutdown with one bus on each of the two units.

Also a nice feature -- oh, diesel. I'm sorry. I'm jumping to the alternate cooling. The diesel-driven standby steamer and feedwater pump, it's a separate diesel-driven standby steamer and feedwater pump. It takes suction from the mineralized water storage tank. It's an extra 500,000 gallons you have right there, and, lastly, we have alternate --

CHAIR SHACK: You'd still need DC power for that to be useful, right?

MR. AVERETT: No.

CHAIR SHACK: No?

MR. AVERETT: It's not like they have W pumps.

CHAIR SHACK: Not like the --

MR. SHAFER: It does have its own battery bank and complete diesel, stand-alone diesel.

MEMBER SKILLMAN: Is that one each for each plant?

MR. AVERETT: No, it's not. It's one big one for both.

MEMBER SKILLMAN: A big one for two units?

MR. AVERETT: Yes.

MEMBER SKILLMAN: And a common header that lets you direct water ever where you want it?

MR. AVERETT: Exactly.

MEMBER BROWN: How long can it run on its own battery bank?

MR. SHAFER: Well, once the diesel starts, it'll self-charge.

MEMBER BROWN: It's self-powered?

MR. SHAFER: That's correct, sir.

MEMBER BROWN: All right, so it's basically a startup battery.

MR. SHAFER: That's correct, sir.

MEMBER SKILLMAN: How much fuel do you have for that engine?

MR. SHAFER: It does have a skid tank on it. I'm not sure what the duration is.

MEMBER SKILLMAN: Is it 24 hours, 72 hours, ten days?

MR. SHAFER: I think it's probably going to be greater than 24 hours, but I could get back with a specific number on it.

MEMBER SKILLMAN: Curiosity question. Thank you.

MEMBER SIEBER: Does that diesel --

MR. SHAFER: No, it's a good question.

(Simultaneous speaking.)

MEMBER SIEBER: -- through any other circuits in the plant?

MR. SHAFER: No, sir. It's a stand-alone day tank.

MEMBER SIEBER: Is it air-cooled or water-cooled?

MR. SHAFER: Water-cooled radiator system.

MEMBER SIEBER: Essentially, a railroad locomotive, right?

MR. SHAFER: Yes, sir.

MEMBER SIEBER: Okay.

MR. SHAFER: Tied to a pump, yes.

MEMBER SCHULTZ: Sam, I'm not sure of the timing associated with the single-unit loss of offsite power events. Has the station blackout cross-tie been used, functionally used?

MR. SHAFER: Is it used? We do our PMs every refueling outage. In addition to that, in a similar scenario we're required annually for the operators to test the time on that.

Our licensing commitment is once the condition is recognized that we are able to cross-tie within ten minutes, and we're very successful doing that. All the controls are right in the control room.

MR. HALE: In fact, I believe we demonstrated that through the ACRS Subcommittee license renewal at Turkey Point. Remember, the

Subcommittee came to the site?

MEMBER SIEBER: I remember.

MR. HALE: Yes, and station blackout was coming up in terms of scope of license renewal.

CHAIR SHACK: That's right. That was a contentious issue at that time.

MR. HALE: Right, and I believe we demonstrated to the Committee. You all came to the site, because we were the first Westinghouse plant.

MEMBER SIEBER: Yes, you had just had a storm before that that did a lot of damage.

MR. HALE: Yes.

MR. AVERETT: Okay. Now, the last thing that's somewhat unique to Turkey Point is we have alternate cooling for the charging pumps, and this is important from an RCP seal LOCA standpoint.

One of the classic RCP seal LOCA scenarios is where you have a loss of CCW, which not only takes out your charging pumps for seal injection, it also takes out your seal cooling, which causes and RCP seal LOCA, and you have CCW cooling the high-head safety injection pumps, too, so you can see how the support systems are going out there and causing problems.

In our case, we have alternate cooling from the service water system for the charging pumps,

and it is a proceduralized practice scenario and is trained on, so if you have a loss of CCW, it doesn't necessarily mean you're going straight to RCP seal LOCA.

To address your concern about the low CDF, it's my concern, as well, initially when it first came out. What I did -- one thing I did was do a sensitivity analysis. I took out credit for the opposite unit RWST injection capability. I also took out credit for station blackout cross-tie, and the number went up to what is typically of Westinghouse units like the low and mid E^{-5} range. Okay.

Also, I'd like to add that we had a team from, I believe it was INL, for the SPAR model review to sit down with us, and they had your concern, as well. After they left, their number was about the same as mine. And we have compared the cut sets from similar plants like Robinson, and in each case where there is a cut set that they have that I don't have, it's design, based on the design difference.

Okay. The results of an internal event analysis showed the CDF increase was about $5E^{-8}$ per year, and the LERF increase was $4E^{-9}$ per year. This is well below the Reg Guide 1174 guidelines, which have a threshold for this significance of $1E^{-6}$ per

year for CDF and $1E^{-7}$ for large early release frequency.

One thing we did to minimize this risk increase was we changed the set point for implementation of bleed-and-feed cooling to a higher steam generator level set point, raised it from 22 percent wide range to 33 percent wide range, which helped out our human error for going to bleed-and-feed cooling, gave the operator more time to do so. We've already covered the second one about the RHR pumps.

So, just to summarize, the small increase in risk due to EPU, it is positive, but it's well below the guidelines in Reg Guide 1174. We made some changes to minimize the risk from EPU, the ones I just mentioned. I already covered the third bullet. The baseline risk for Turkey Point is lower than average based on unique design features, and that's all I have.

MR. HALE: Any other questions from the Committee?

MEMBER SCHULTZ: Mark, you just mentioned that the set point for implementation of bleed-and-feed cooling was increased and that that was an assistance to the operational staff. Was that identified previously? It certainly came up as an

opportunity during uprate, but is that something that you had on the books to change or examine because of the operator action times?

MR. SHAFER: This is Sam Shafer from Florida Power & Light. Not that I recall, sir. I know that for EPU it's going to bring it up to 33 percent, but 22 is what we've been trained on and what's standard for us.

MR. AVERETT: I think it actually was a result of our initial results of the PRA. You know, I think the increase was more than $5E^{-8}$, but it was still less than $1E^{-6}$, but they asked us, "Well, what can we do to lower it?" and I just looked at the top cut sets, and I said, "Well, you know, if we had more time to do this, that could have a good impact."

So they want something similar to St. Lucie, and so we did it at Turkey Point, and I factored that into the human liability analysis. Sure enough, it made a substantial difference. I wish I could tell you what the difference was, but it made a non-negligible difference in the increase.

MEMBER SCHULTZ: Thank you.

MR. HALE: That's all we had, hopefully clarified some of the questions we had from the full Committee meeting. Okay, thank you.

CHAIR SHACK: Just be prepared to repeat it when John gets back.

MR. HALE: Okay. All right.

CHAIR SHACK: We're ahead of schedule here, but I don't think anybody will object to taking a little early break so we can do a changeover to go to our proprietary session. So we'll be back at 9:35.

(Whereupon, the above-entitled matter went off the record at 9:20 a.m. and resumed at 9:37 a.m.)

CHAIR SHACK: Okay. We're going to come back into session now. Mr. Parks, I assume you'll start the show.

MR. ULSES: Actually, Mr. Chairman, this is Anthony Ulses. I'm the Branch Chief of Reactor Systems. I just kind of want to introduce this topic briefly. One thing I wanted to touch on, as well, a little bit of the history and the time line here.

We know there have been some questions about how we got to where we are, but what you're going to hear from us today is a description of the TCD impact on the specific field mechanical code, and then we're going to -- then we're also going to discuss how that impacts the downstream safety analysis.

But to speak briefly about the history of

where we are now, as we've heard from the members today, this is not a new issue. You know, we've known about thermal conductivity degradation for quite a while.

What is new was the specific impact as you work the effect of the phenomena all the way through the entire evaluation model. We had never seen an actual impact assessment in a quantitative fashion until early December, and after we got that information, we acted very aggressively.

We issued an Information Notice within five days in order to get that information out to licensees, and our expectation at that time was that they would take that information, and they would look at their regulatory requirements under 10 CFR 50.46, and they would take action.

Up until about a week -- up until two or three weeks ago, we had not seen any reports of errors, as we would have -- as we would have expected to have seen under 50.46. So, lacking that information, we were compelled to issue a series of 50.54(f) letters, which are requests for information, and those information requests are specifically targeted at getting information to allow the staff to verify compliance with 50.46 requirements.

Again, ensuring compliance is a licensee responsibility. Our role is to verify compliance, and, you know, that again was an action that we took very expeditiously after we got to the point where we had not seen the information that we thought we were going to get.

Again, this is all at the point that we're trying to gather information so we can understand the plant-specific impact of this error and so we could ensure that the appropriate regulatory requirements are being complied with.

So I just kind of wanted to go over briefly the history of how we got to where we are today, and as we heard from Mr. Howe this morning, the answers to his letters are due by 19 March, and we'll assess that information, and we'll act accordingly after we get it.

MEMBER BANERJEE: So, Tony, what did you see, and who did the analysis in December that brought this to your attention?

MR. ULSES: Well, the actual -- the actual specific utility is proprietary. I can answer the question in, I'm assuming, a couple of minutes here once we go into closed session.

MEMBER BANERJEE: All right.

MEMBER ARMIJO: Well, I have a --

MEMBER BANERJEE: We can address these questions in closed session.

MEMBER ARMIJO: I have a -- I have a broader question is it's obvious that the thermal conductivity degradation will have a downstream effect on your safety analyses, and when the -- so why did the -- why was there such complacency in addressing this problem?

You know, if you get new data to put into your codes, you don't just stop with some very limited fuel mechanical design issue. You take it all the way down to the end of the line. It seems like this is a problem that should have been addressed a long time ago, and I don't understand what arguments there are or basis for not doing it sooner.

MR. ULSES: Well, you know, I can't specifically myself address the history of this issue, but I can tell you that we have -- we did an evaluation in 2009 when we issued the Information Notice where we made the first -- you know, this is an issue to licensees.

At the time, again, you know, we had not done a -- we had not looked at the actual specific impact on all of the analysis. That was more of a

qualitative assessment, and our expectation, again, was that licensees would take that information, and they would take appropriate action, but I also think you're going to hear a little bit of discussion on this is that this is --

You know, there are -- there are many competing effects, obviously, in all these analytical tools, and it's not always entirely clear how the impact is going to manifest itself as the overall answer.

CHAIR SHACK: But still, it seems like it should have been the first RAI you ask whenever you get an EPU, and it's up to the licensee to defend the result. I mean, it's not -- yours is to ask the question, up to them to come up with a satisfactory answer.

MR. ULSES: And we have asked RAIs on this. You know, this particular EPU was not the first point that we've actually addressed.

CHAIR SHACK: It's the first one we've heard about.

MR. ULSES: It's the first one where we had an issue.

CHAIR SHACK: Why wasn't this the first RAI on this EPU? I mean, we heard about it at sort of

the end of the process, rather than at the beginning.

MR. ULSES: Again, it's because of the timing of the information received, and that was early December, and that's unfortunately something we can't control is when that information comes to us, but we acted.

DR. WALLIS: Tony, have you seen the letter from Sam Collins when he was the EDO, Jun 6, 2002, that said that PAD 4.0 TCD was a licensing condition for this plant?

MR. ULSES: I actually have not personally seen that.

DR. WALLIS: If that's a licensing condition, why TCD wasn't in there right away, ten years ago?

MR. ULSES: You know, I have not personally seen that letter, but, again, this is not a new phenomenon, as I said, and it's something that we've known about for quite a while. The data, I believe, was taken in 1996, I think, which has led to all this effort.

MEMBER ARMIJO: I think Dr. Wallis' question is more regulatory enforcement of a letter written by the EDO that says, "Hey, this is a rule for the road. Somehow it didn't get implemented."

MEMBER BANERJEE: Well, you don't know it was not implemented.

MEMBER ARMIJO: Well, here we are. It's coming up as an issue.

MEMBER BANERJEE: Well, it's coming up an issue, the EPU, right?

MEMBER ARMIJO: It was a licensing issue before EPU.

MEMBER BANERJEE: Yes, it was the 2002 letter.

MEMBER ARMIJO: Right.

MR. ULSES: All I can offer on that at this point is that we have undertaken an effort to look at the extended condition of this issue, and we're looking at it very aggressively, and there will be more to come as we take a look into this.

MEMBER SIEBER: The Halden data is the trigger.

CHAIR SHACK: Okay. Well, we can move on, I think.

MEMBER REMPE: When you say that there is more to come, could you elaborate? I mean, we're going -- we're looking at the EPU now. Are you planning to do more with --

MR. ULSES: I'm sorry. The question broke

up, ma'am. Could you repeat that?

MEMBER REMPE: You said that you're starting to look at this, and there will be more to come. Are you talking about other plants or Turkey Point?

MR. ULSES: Not for Turkey Point specifically. As you're going to see here, we're satisfied that Turkey Point has addressed this issue technically. We're looking at a broader perspective, looking across the industry to see how this may have impacted other types of analyses and other areas of regulatory compliance.

MEMBER REMPE: Okay.

DR. WALLIS: Well, why is it so complicated for someone like Westinghouse to put this information into a code and use it?

MR. CLIFFORD: I wouldn't -- I'll address that. This is Paul Clifford. I wouldn't say it's complicated, but it takes a lot of effort. It takes a long time to calibrate a model, especially when you're talking fuel temperature, because once you change fuel temperature, you've got to go back and recalibrate all of your other models, because temperature is a driving force for so many other phenomena that occur in the fuel rod.

Then you need to validate those, and then you need to document it, and then you submit it to the NRC, and then the staff needs to review that. That takes years of effort, and it's not like the industry has been stagnant on this issue. I mean, we have approved several codes.

DR. WALLIS: I don't understand. It's just an input to a code.

MR. CLIFFORD: It's a model in a code.

DR. WALLIS: It's an input. You put in the conductivity as it is.

MR. CLIFFORD: It's a model.

DR. WALLIS: And it's a function of burnup. Maybe that's the problem. I would think it's a one-liner. I mean, just put it in.

MEMBER BANERJEE: Well, but it also affects fission gas, all sorts of things.

DR. WALLIS: It affects things, but putting it in is not a problem. Putting it will put the effects.

MEMBER BANERJEE: All the implications are complicated.

DR. WALLIS: Seems like a homework problem to me.

CHAIR SHACK: We're starting as sophomores

again.

MR. CLIFFORD: Okay, I'll begin this presentation describing the interim solution that FP&L took to address thermal conductivity degradation. That will involve a revision to the PAD4 code and some benchmark calculations performed by the staff using FRAPCON to verify the accuracy of the new version of the code.

I'll be followed by Ben Parks, who will be talking about the downstream effects, and, finally, Shih-Liang Wu will talk about fuel seismic design requirements.

MEMBER ARMIJO: Paul, before you go forward, I want to back you up just a little bit. It was these Halden experiments that really gave us quantitative data on the degradation of -- thermal conductivity degradation.

I re-looked at those documents, and the highest burnup fuel rod that they tested, instrumented fuel rod, was, I think, about 30,000 megawatts-day per ton. Did they go higher than that? Did they go as high as -- how high did they go?

MR. CLIFFORD: I know there are rods up over 60 gigawatts-day.

MEMBER ARMIJO: Okay, so that was my big

concern is that we cover the whole burnup range of interest today.

MR. CLIFFORD: Right. Right, I could provide you with the NUREG/CR-7022, which is the FRAPCON validation, which describes the empirical database for Halden.

MEMBER ARMIJO: You don't need to do that. As long as it went up to a height of 60, 70 gigawatts-day per ton, that makes me happy.

MEMBER BANERJEE: If I remember, though, with the higher burnups it sort of flattens out, right? The thermal conductivity comes --

MR. CLIFFORD: Yes, I have a slide on that you'll see.

MR. KERSTING: This is Paul Kersting from Westinghouse. The IFA 562 tests had burnups over 80,000, so they were fairly high burnup, and there are other IFA series tests that also were up over 60,000 to 70,000.

MEMBER ARMIJO: Okay, good. Thank you.

MR. CLIFFORD: Okay. The original License Amendment Request submitted by FP&L to support the Turkey Point EPU used the approved version of PAD, PAD 4.0.

MR. WANG: Excuse me, Mr. Chairman. I

think we are going to closed or -

MR. CLIFFORD: I think the next slide starts. The next starts. Okay, so the original -- the currently approved version of PAD, PAD 4.0, does not account for TCD.

In response to staff concerns in REIs, FP&L proposed an interim solution whereby they would modify the version of PAD and then use the modified version of PAD for the fuel mechanical design and all -- and to generate input to all downstream safety analysis, for example, LOCA stored energy. That's an interim path forward, and for the long term FP&L has committed to implement the formal revision to PAD once it becomes available.

CHAIR SHACK: Okay. I think we're going to go into closed session now.

(Whereupon, the above-entitled matter went off the record at 9:49 a.m.)

Turkey Point
Extended Power Uprate (EPU)
ACRS Subcommittee

February 24, 2012

Agenda

Introduction ……. Mike Kiley

- **Status of Review…….. Steve Hale**
- **Discussion Topics from ACRS Full Committee**
  - Loss of Load Overview…… Steve Hale
  - Loss of Off Site Power Overview…….. Steve Hale
  - Shared Systems Overview……..... Steve Hale
  - Probabilistic Safety Assessment …… Mark Averett

Turkey Point

- **FPL appreciates the opportunity to discuss the EPU License Amendment Request for Turkey Point with the ACRS Subcommittee**
- **Since the last ACRS Subcommittee and Full Committee meetings, FPL and NRC Staff have been working diligently to close the open items**
- **FPL recognizes and appreciates the importance of the Staff's questions, particularly those on Thermal Conductivity Degradation (TCD)**
  - NRC Staff performed a detailed review of FPL's analysis including a multi-day audit where FPL provided Staff with its analyses
  - This audit and the others performed by NRC Staff have been invaluable to the result of a thorough and comprehensive review of the proposed EPU
- **The open items have been addressed and FPL looks forward to answering any remaining questions**

FPL

Agenda

- **Introduction …… Mike Kiley**
- **Status of Review…… Steve Hale**
- **Discussion Topics from Full Committee**
  - Loss of Load Overview…… Steve Hale
  - Loss of Off Site Power Overview…….. Steve Hale
  - Shared Systems Overview……..... Steve Hale
  - Probabilistic Safety Assessment …… Mark Averett

FPL provided responses to close the draft Safety Evaluation open items

- **At the ACRS Full Committee Meeting, there were 4 open items related to the Turkey Point EPU Safety Evaluation (SE)**
  - New Fuel Storage Area Technical Specification (TS)
  - Nuclear Fuel Thermal Conductivity Degradation (TCD)
  - Fuel Seismic/LOCA loading
  - I&C RAIs
- **FPL provided input to NRC Staff to address remaining open items, RAIs and actions from ACRS Meetings**
- **NRC Staff issued the revised draft SE**

FPL

Agenda

- **Introduction …… Mike Kiley**
- **Status of Review…….. Steve Hale**
- **Discussion Topics from Full Committee**
  - Loss of Load Overview…… Steve Hale
  - Loss of Off Site Power Overview…….. Steve Hale
  - Shared Systems Overview……..... Steve Hale
  - Probabilistic Safety Assessment …… Mark Averett

Loss of load analysis results assuming higher initial pressurizer pressure confirms lower pressure is conservative

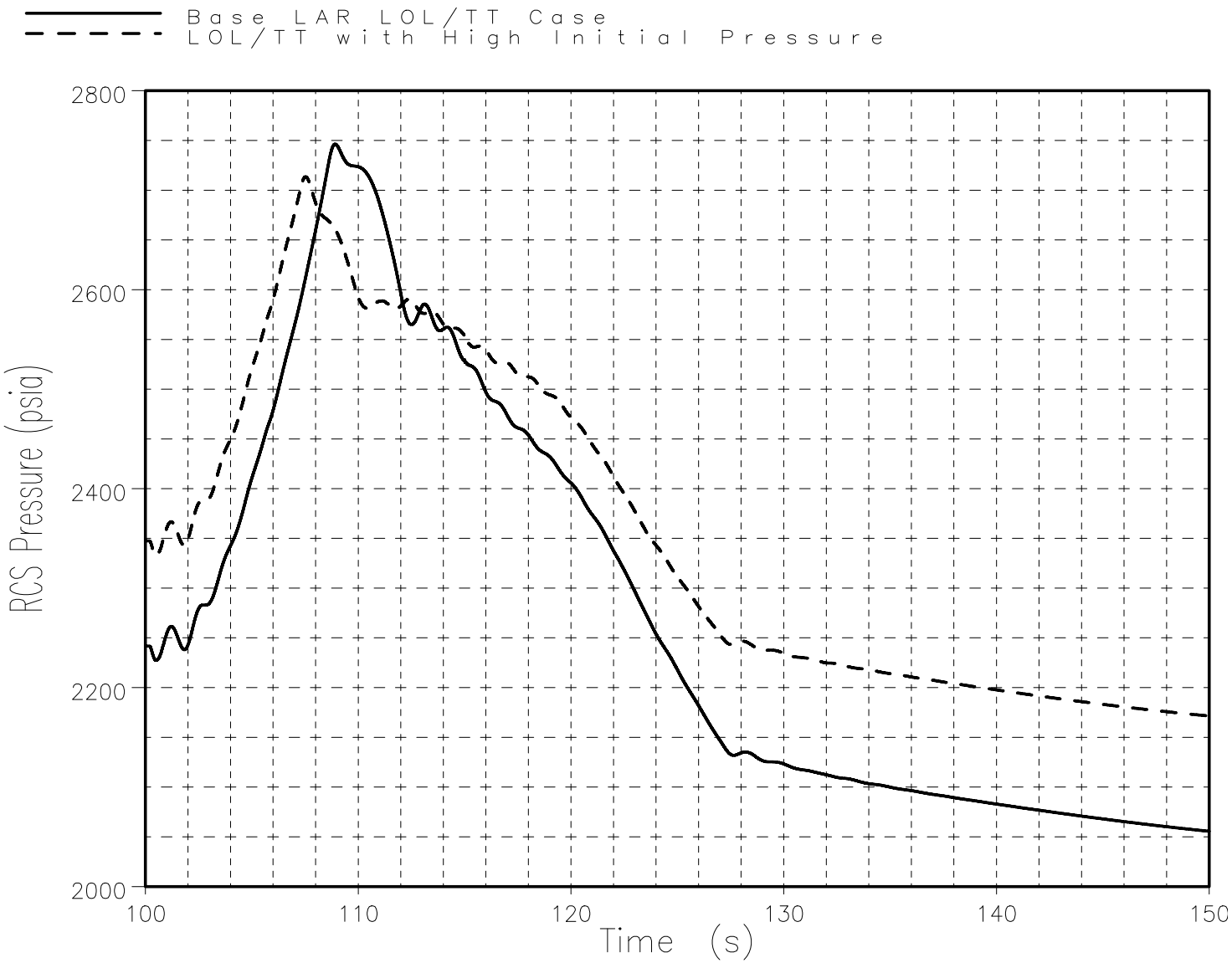
- **Action Item – Perform loss of load analysis assuming nominal pressurizer pressure plus maximum pressure uncertainty vs. current analysis which assumes nominal pressurizer pressure minus maximum pressure uncertainty**

Event	Licensing Report Case	High Initial Pressurizer Pressure Case
	Time (sec.)	Time (sec.)
Loss of Load/Turbine Trip Initiated	0.0	0.0
High Pressurizer Pressure Reactor Trip setpoint (2455 psia) reached	6.3	4.9
Rod motion begins	8.3	6.9
Peak RCS pressure occurs	8.9 (2746.6 psia)	7.5 (2713.8 psia)

- **Results – Earlier reactor trip reduces severity**

FPL

Loss of load analysis results assuming higher initial pressurizer pressure confirms lower pressure is conservative



Agenda

- **Introduction ……. Mike Kiley**
- **Status of Review…….. Steve Hale**
- **Discussion Topics from Full Committee**
  - Loss of Load Overview…… Steve Hale
  - Loss of Off Site Power Overview..…….. Steve Hale
  - Shared Systems Overview…….…..... Steve Hale
  - Probabilistic Safety Assessment …… Mark Averett

Although highly unlikely, dual unit loss of offsite power (LOOP) will not result in the pressurizer filling

- **Since 1990, only one dual-unit LOOP**
  - August 1992, as a result of Hurricane Andrew
  - Both units placed in a safe shutdown condition prior to onset of hurricane force winds
- **4 single unit LOOP events, 2 on each unit**
  - Caused by unit internal or switchyard faults/failures
  - Not initiated from the grid
- **Risk associated with a dual-unit LOOP**
  - Dual-unit LOOP frequency = 0.02 per year
  - CDF (dual-unit LOOP) = 8E-08 per year
- **Transient analysis demonstrates that the pressurizer will not fill with a LOOP**
  - Results are comparable to current licensing basis
- **No new Operator actions added for LOOP as a result of EPU**

FPL

Agenda

- **Introduction …… Mike Kiley**
- **Background …….... Steve Hale**
- **Status of Review…….. Steve Hale**
- **Discussion Topics from Full Committee**
  - Loss of Load Overview…… Steve Hale
  - Loss of Off Site Power Overview…… Steve Hale
  - Shared Systems Overview…….... Steve Hale
  - Probabilistic Safety Assessment …….. Mark Averett

The shared systems provide flexibility and safety benefits

Shared Systems
for Turkey Point Units 3 and 4

- **Emergency Core Cooling System**
  - 4 pumps which all start on SI signal from either unit
    - -- 2 required for LOCA, only 1 required for other events
    - -- Each pump aligned to separate emergency diesel generator
- **Auxiliary Feedwater System**
  - 3 turbine driven pumps
    - -- 1 required to satisfy heat removal requirements of both units
    - -- Capable of performing design function without AC power
  - 1 diesel driven standby feedwater pump
- **Emergency Diesel Generators (EDGs)**
  - 4 EDGs, 2 for each unit; all start on SI signal from either unit
  - EDGs can be cross tied from the Control Room
  - Each EDG has sufficient capacity to maintain both units in a safe shutdown condition

FPL

Agenda

- **Introduction ……. Mike Kiley**
- **Status of Review…….. Steve Hale**
- **Discussion Topics from Full Committee**
  - Loss of Load Overview…… Steve Hale
  - Loss of Off Site Power Overview…….. Steve Hale
  - Shared Systems Overview……..... Steve Hale
  - Probabilistic Safety Assessment …… Mark Averett

Probabilistic Risk Assessment (PRA) was used to calculate the EPU's impact on risk

PRA Risk Assessment of EPU

- **EPU is not a risk-informed submittal**
- **Risk impact of EPU was calculated using the Turkey Point dual-unit, internal events PRA model**
- **Internal Events PRA Model**
  - Updated in March 2010
  - Data current through December 31, 2006
  - Quantifies Core Damage Frequency (CDF) and Large Early Release Frequency (LERF)
- **Internal Flooding**
  - IPE screening analysis

FPL

The assessment also included external events and shutdown risks

PRA Risk Assessment of EPU - External Events / Shutdown Risk

- **External Events**
  - Seismic (low seismicity area, IPEEE walkdowns)
  - Internal Fire Events (IPEEE)
  - High winds, External floods, Transportation events (IPEEE)
- **Shutdown Risk**
  - Defense-in-depth
  - Implemented procedurally

FPL

The baseline models were updated for EPU conditions

Method

- **Updated Baseline Internal Events Models for EPU**
  - Logic models changed to reflect physical changes planned for EPU
  - Human Reliability Analysis (HRA) updated to reflect EPU-related timing changes
  - LOCA success criteria revised
  - Offsite power recovery credit revised to reflect EPU
- **External Events**
  - Assessed qualitatively
- **Shutdown Risk**
  - Assessed qualitatively

FPL

Turkey Point's CDF is lower than most Westinghouse units

Turkey Point Unique Safety Features

- Opposite-unit RWST injection capability
- Redundancy level of four for high-pressure injection for small-break LOCAs and bleed-and-feed cooling
- Station Blackout (SBO) Crosstie
- Diesel-driven Standby Steam Generator Feedwater (SSGFW)
- Alternate cooling for charging pumps

Removing credit for opposite-unit RWST injection and SBO crosstie results in a higher CDF which is more typical of Westinghouse units

FPL

The results indicate a slight increase in risk from an already low baseline (pre-EPU) risk

Results

- **Slight increase in Risk**
  - CDF increase of 5E-08 per year
  - LERF increase of 4E-09 per year
- **Risk increase is well below the NRC Reg Guide 1.174 thresholds for risk significance of plant changes**
- **Changes to minimize Risk increase:**
  - Setpoint for implementation of bleed-and-feed cooling was increased from a SG level of 22%WR to 33%WR.
  - Procedure step to shut off RHR pumps in the event of a LOCA where pressure remains high was moved to a point earlier in the procedure.

FPL

The small increase in risk is considered non-risk-significant per the guidelines in Reg Guide 1.174

Summary

- There was a small increase in risk due to EPU
- Some changes were made to minimize the risk from EPU
- Risk increase is well below the NRC Reg Guide 1.174 thresholds for risk significance of plant changes
- Baseline risk for Turkey Point is lower than average
- Unique crossties and redundancies are the reasons for the lower risk values

FPL

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

Introduction

Allen G. Howe

Deputy Division Director

Division of Operating Reactor Licensing

Office of Nuclear Reactor Regulation

Jason C. Paige

Project Manager

Division of Operating Reactor Licensing

Office of Nuclear Reactor Regulation

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

Introduction

- Background
  - ❖ TP EPU Application – October 21, 2010
  - ❖ 2300 to 2644 MWt, 15 % increase (344 MWt)
    - Includes a 13 % power uprate and a 1.7 % MUR
    - 20 % increase above original licensed thermal power
- EPU Review Schedule
  - ❖ Followed RS-001
  - ❖ Linked licensing actions
    - AST – approved June 23, 2011
    - SFP Criticality analysis – approved October 31, 2011
  - ❖ Supplemental responses to NRC staff RAIs and Audits

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

Open Items From January 19, 2012 ACRS Full Committee meeting

- Thermal Conductivity Degradation
- Fuel System Design, Grid Crush
- I&C Uncertainty Allowance Values
- New Fuel Storage EPU TS supplement

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

Topics for Subcommittee

- EPU Overview
- Discussion Topics from ACRS Full Committee Meeting
  - ❖Loss of Load Overview
  - ❖Loss of Offsite Power Overview
  - ❖Shared Systems Overview
  - ❖Probabilistic Safety Assessment
- Thermal Conductivity Degradation
- Fuel System Design, Grid Crush

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

Turkey Point EPU LAR Review:

Fuel Thermal Conductivity Degradation

February 24, 2012

Paul Clifford, Benjamin Parks, Shih-Liang Wu
Division of Safety Systems
Office of Nuclear Reactor Regulation

Agenda

1. TCD Interim Solution
2. PAD4TCD Thermal Conductivity Model
3. Benchmark Calculations
4. Downstream Safety Analysis Impact
5. Westinghouse ASTRUM Revisions

TCD Interim Solution

- Turkey Point EPU LAR employed Westinghouse PAD 4.0 fuel rod performance code
  - Approved version of PAD 4.0 does not account for thermal conductivity degradation (TCD) with exposure
- In response to staff concerns, FPL proposed an interim solution involving a modified version of PAD which properly accounts for TCD
  - Modified PAD replaced PAD 4.0 for fuel thermal-mechanical design analysis and input to downstream analyses (e.g., LOCA stored energy)
  - FPL has provided a commitment to implement the formal revision to PAD once it becomes available