Official Transcript of Proceedings

NUCLEAR REGULATORY COMMISSION

Title:	Advisory Committee on Reactor Safeguards Plant Operations and Fire Protection Open Session
Docket Number:	(n/a)
Location:	Rockville, Maryland
Date:	Thursday, October 5, 2011

Work Order No.: NRC-1182 Pages 1-162

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NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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PLANT OPERATIONS AND FIRE PROTECTION SUBCOMMITTEE

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OPEN SESSION

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THURSDAY, OCTOBER 5, 2011

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ROCKVILLE, MARYLAND

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

Reporter: Charles Morrison

SUBCOMMITTEE MEMBERS PRESENT:

HAROLD B. RAY, Chairman

CHARLES H. BROWN, JR.

MICHAEL T. RYAN

GORDON R. SKILLMAN

JOHN W. STETKAR

NRC STAFF PRESENT:

GIRIJA SHUKLA, Designated Federal Official

PATRICK MILANO

RAGS RAGHAVAN

JUSTIN POOLE

KAMAL MANOLY

MATHEW PANICKER

DAVID RAHN

ALSO PRESENT:

DAVID STINSON

ROBERT BRYAN

PENNY SELMAN

STEVE SMITH

STEVE HILMES

GREG LOWE

GORDON ARENT

MIKE HEIBEL

TABLE OF CONTENTS

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

8:30 a.m.

CHAIR RAY: The meeting will now come to order.

This is a meeting of the Advisory Committee on Reactor Safeguard Subcommittee on Plant Operations and Fire Protection, the Watts Bar Unit 2.

Subcommittee members in attendance are John Stetkar, Charles Brown and Michael Ryan.

Part of the meeting will be closed to the public attendance, to discuss security-related information and according to the schedule we have in front of us, this will occur following the lunch break.

I want to note that the meeting room will be -- we're hot-bunking it today, and the meeting room will be used by another group from 12:00 p.m. to 1:00 p.m., so, if we're running late, we'll have to stop wherever we are. If we're ahead of schedule, we may break early, so that we can then resume with the afternoon's planned schedule at one o'clock.

Girija Shukal of the ACRS staff is the Designated Federal Official for this meeting.

The Subcommittee will hear presentations from the NRC staff and the Applicant Tennessee Valley

Authority, regarding the status of the construction inspection and licensing activities related to Watts Bar Nuclear Plant Unit 2.

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

The Subcommittee will gather information, analyze relevant 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 published in the Federal Register on October 3, 2011.

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 that they may be readily heard.

Please silence your cell phones during the meeting.

Now, we're about to proceed with the meeting. We'll begin with discussion by NRC staff, Patrick Milano, and Patrick, if you don't mind, I'd like to ask you some questions as well, since we prepared for this meeting and I think it would be appropriate.

But if you have initial comments you'd like to make, please proceed.

MR. MILANO: Thank you, Mr. Ray. Good morning, Mr. Ray and other members of the Subcommittee.

Again, my name is Patrick Milano. I'm the Senior Licensing Project Manager in the Office of Nuclear Reactor Regulation Division of Operating Reactor Licensing.

With me today, there is Mr. Raghavan, who is our team leader for the Watts Bar special project, and to my left is Justin Poole, who is also one of the project managers assigned.

We have with -- from the region, we have Mr. Bob Haag. He is available here to answer questions, however, because of today's meeting, we're not going to have a specific discussion, with regard to the status of the inspection program. But if questions come up during the course of the presentation, he'll be here to answer them.

We're here before the Subcommittee today, to continue on our -- with our presentations on the status review of the Operating License Application for TVA's Watts Bar Unit 2.

In addition to giving you a brief overview of the status, we will be focusing on what has transpired since the last meeting that we had with the Subcommittee in July of this year.

Shortly, TVA will be providing you with its current status of the facility construction, followed by a discussion of the areas of the FSAR, that were discussed in the staff's latest supplement to the Safety Evaluation Report.

Because the subject matter to be discussed in the presentation on cyber security is being withheld from the public under 10 CFR 2.309, that portion of the presentation this afternoon, as you indicated, will be closed to the public.

After TVA's presentation, the staff will provide its status of the licencing and construction -- a short discussion of the status of the licensing programs, and then we'll discuss the staff's conclusions presented in both Supplement 23 and Supplement 24.

As you'll remember from last month, we came in here to discuss a number of items, in addition to the instrumentation and control section, and so, what we're going to do is, is we're going to pick up on some of the key items that we were unable to present to you in July, and then we're going to follow up with the key items that are coming out of Supplement 24.

So, it's a combination of 23 and 24 that will be presented this time.

Unless you have some specific questions right now, our plan was to turn the presentation over to TVA, to provide its discussion of these major activity areas.

CHAIR RAY: Well, as I indicated, I do have some questions.

MR. MILANO: All right.

CHAIR RAY: So, let's stick with the present dialog for a bit longer.

As you say, Supplement 24 is the most recent SER that we have in hand.

MR. MILANO: Yes.

CHAIR RAY: And we've read that, coming into the meeting, and frankly, Patrick, I'm concerned about -- you characterize this as a -- I don't remember the exact words, but anyway, that we're continuing a process.

MR. MILANO: Yes.

CHAIR RAY: Well, this SER has over 100 open items. It's got a 134 action items, total, but a few of them are closed, and I guess I'm trying to get some clarity about how we make progress with as much open, as we have.

I mean, are we thinking that these chapters and partial chapters and so on, are behind us, as a result of this review, today, because it just seems hard to come to any conclusion with as much open as there is, right now, and it's puzzling, why there should be so much, and I'm sure the Commission would be puzzled too.

How would you describe where we go from here, assuming we complete today's review process, as you have it planned?

MR. MILANO: Well, first, let me step back a minute and characterize what's in the list of open items.

CHAIR RAY: I've read them.

MR. MILANO: And so, it -- actually, it falls into two categories.

One are open items that are preventing the staff to come to a final conclusion on -- to make -- to determine it's reasonable assurance on any -- on the specific section of the FSAR.

However, the majority of the open items are items that need to be confirmed in the field or through submission of documentation from TVA.

The staff has made its conclusions subject to certain beliefs of what TVA was going to be doing, and a number of the items that are characterized as confirmatory items are just, either TVA provide something to us and we -- and we, meaning the NRR staff, agrees that that is, in deed, what we based our conclusions on, or it's the region provides an inspection to confirm that the assumptions that we made in coming to our conclusion are, in deed, correct.

Those items that fall into the earlier category, what we consider to be open, in the fact that we haven't made our reasonable assurance -- our final reasonable assurance determination, we're not saying that we are not going to be discussing them again with you.

Our hopes is, is in the next couple of Subcommittee meetings that we have, in addition to presenting to you, those sections of the FSAR that we had not discussed with you in the past, what we're going to be doing too is, is we're going to be discussing with you, the open items and how the staff came to its conclusion that everything was wrapped up in the -- in that specific SER section.

So, we will be discussing some of the open times with you in the future meetings.

CHAIR RAY: All right, but as you say, there are some that -- many, in fact, not all, by any means, that are listed as confirmatory items and presumably, we can discern from the SER, what would -- what your expectation is that you want to have confirmed, and there are others that are not.

Here is one, for example. It might be of interest to some of my colleagues, "TVA should provide the staff either," -- it's 94, "Should provide the staff either information that demonstrates that the Watts Bar Unit 2 Common Q PAMS meets the applicable requirements in IEEE Standard 603, or justification for why it should not meet those requirements."

Well, okay, that's fine, that's an open item, but it's the sort of thing that we certainly want to know, if you're satisfied by some other means, what that was, and whether --

So, it just -- I guess I just want to make note of that fact that these are not only partial chapters, but they're lacking in a lot of information, some of which is merely confirmatory and we can say, "Okay, fine," if it's not confirmed, and we assume to come back.

But some of it, like what I just read there, could entail something quite unexpected from our standpoint.

Well, I've made note of it, and that's all I'll do for the moment. I just -- if we had to say something right now, about the status of things, it would be that, well, we've looked at a good deal, but there is a lot that's still outstanding, much of it, we would like to know what the resolution is.

MR. MILANO: And you will see, especially when we come up and present to you in December, you know, you will start to see some of these open items being closed, and those items, like 94 that you just indicated, those type of items that are holding open, the staff's final reasonable assurance on that section, you will see a specific write-up in the SER.

Those items that are just confirmatory in nature, the staff's plan is, is they will be -- they'll only be reference to whatever documentation exists that shows that that item was confirmed, and was confirmed successfully, whether it's a -- let's say, an NRC inspection report, and stuff. There will be reference to it, because it hasn't changed the staff's conclusion.

If, on confirmation, we find that that is not the case, that what is being provided does not confirm what the staff's conclusions, assumptions were, and stuff, then you will see a new write-up in the appropriate -- in the appropriate section of the SER.

CHAIR RAY: Yes, well, I understand that, but of course, we have a responsibility to do more than just be informed that you're satisfied.

MR. MILANO: Yes.

CHAIR RAY: On things, and you know, just to pick another one here, 93, TVA should confirm to the staff, that testing in EAGLE 21 system has sufficiently demonstrated that two-way communication of the ICS has precluded with the described configurations.

Well, sufficiently demonstrated, that might be something of interest to members. What does it take to be -- to have it be sufficiently demonstrated?

I'm just -- I want to move on, now, but I just want to point out that there is a lot here that leaves me wondering how we're going to get closure, and I anticipate some bow wave building up, in which we're scrambling, trying to go back through here, and figure out what is it that we weren't able to even gain any insight to, because of its status, and need to, therefore, provide more review of.

Let me shift, Patrick, to another question, because I'd like repeat. I know it's in the record somewhere, in the past, but I'd like to just freshen up our perspective on the following point.

The write-up on geology and seismology spans, two and a quarter pages, most of which has to do with settlement, and with regard to geology and seismology, in fact, there is only one pertinent sentence that says, "The staff concluded that TVA did not make any changes to FSAR Section 2.5 through 2.5.3, or to Section 2.5.5, dealing with the geological and seismological aspects of Watts Bar Unit 2, compared to those aspects which were reviewed and approved by the NRC staff, at the time of licensing of Watts Bar Unit 1 in 1996."

Okay, now, I -- we're all very mindful that this is a Part 50 proceeding, in which we're following on Unit 1 licensing, and we have some very particular policy direction to follow, in that regard.

On the other hand, for that to be the only thing that's said, having to do with Watts Bar Unit 2, it makes we feel like, well, there needs to be something more said, or at least reiterated, as to how and when the issues that are before the Commission today, and I'm presuming the answer clearly is, that this will simply be treated as an operating plant would be treated, when it comes to GSI-191 and the generic letter, whatever it turns out to be, all that other stuff.

This is an operating plant, from that standpoint, correct?

MR. MILANO: That is correct.

CHAIR RAY: All right, and yet, I'm just sort of surprised that there is nothing more said than that sentence I read.

MR. MILANO: In most of the -- in the direction that was given to the technical staff was that if there was nothing -- in its review, if the area was previously reviewed and the conclusions made were still valid and stuff -- that they actually didn't even need to write up a new -- like new Section 2.5.4, or whatever we're reading --

CHAIR RAY: Yes.

MR. MILANO: -- and stuff. In this case here, we did not stop the staff, that if they -- that if for -- just for clarity purposes, they felt it necessary -- they felt a desire to just make a conclusion -- a conclusion-atory type statement, saying that, they re-assessed everything that was there, and they -- and the conclusions that were made in 1995 and 1996 still remain valid and stuff, we did not stop those.

So, in some areas, as you pointed out there, you'll see those type of statements.

However, in the majority of the FSAR sections, the staff just -- if the previous conclusion remained in tact, they just did not write anything new up, and that is --

CHAIR RAY: Well, there's no plan to be made here that the prior conclusions remain valid, and I am interpreting this to mean, that the prior conclusions, which apply to Unit 1, which is clearly an operating plant, will apply to Unit 2, as well, as if it were an operating plant.

Meaning, that any changes then, that occur -- that affect operating plants, will affect both Units 1 and 2.

MR. MILANO: That is correct.

CHAIR RAY: That is different than saying that conclusions remain valid, at least as I view it.

MR. MILANO: Okay.

CHAIR RAY: It's just a statement that this is being treated as an operating plant, and when it comes to seismology and geology.

MR. MILANO: That is correct, it's -- in some of these areas, you're right, this is -- and as you saw it, you know, from the title of the SER, it is a -- it is a Watts Bar Units 1 and 2 SER, and stuff, and there is -- we've recognized that a -- you know, it is a single site.

You can't -- you can't split some of these things apart and --

CHAIR RAY: Well, on the other hand, there is a lot of discussion about hydrology. What is the difference?

MR. MILANO: The reason why is because there were -- there was some major -- there were some major changes in the area of hydrology, and TVA is going to spend some time with you, in its presentation, of what led up to it.

But just -- not to steal their thunder, but in that area, during the review for the proposed Bellefonte 3 and 4, the Office of New Reactors found some discrepancies with the river model in that area, and brought into question, the code that's used to determine -- you know, determine these maximum flood levels and also, how the river is operated, and stuff, were drawn into questions.

There were quality assurance issues. There were some assumptions that were in error and stuff like that.

So, that was completely re-done by TVA, so, that is basically why it was --

CHAIR RAY: All right.

MR. MILANO: -- it was reviewed to that nature.

CHAIR RAY: But you -- in this dialog we just had, there is a big distinction between the hydrology, how it's treated, seismology, how it's treated.

MR. MILANO: Yes.

CHAIR RAY: And yet, stepping back, a lot of people would say, there is as much in play today in seismology as there is in hydrology, and the reason why this distinction is made, apparently, is the hydrology is uniquely associated with Watts Bar.

MR. MILANO: That's correct.

CHAIR RAY: As the seismology, at least in the Southeast, for example, applies to lots of other plants, and again, go back to the operating-plant model.

MR. MILANO: That is correct.

CHAIR RAY: I just want to be clear about that, because I think if we were to write a letter today, we'd certainly at least make that observation.

MR. MILANO: Yes.

CHAIR RAY: Okay?

MR. MILANO: Yes.

CHAIR RAY: But we're not going to write a letter today.

MR. MILANO: No, we are not.

CHAIR RAY: All right.

MR. RAGHAVAN: Can I?

MR. MILANO: Yes, go ahead, Mr. Raghavan.

CHAIR RAY: Yes.

MR. RAGHAVAN: My name is Bob Raghavan. I'm the team leader for the Watts Bar.

I just wanted to clarity one thing on this.

You have to look at the Unit 2, whether it meets the current requirements that exist in the NRC right now, and that is part of the license, and as part of the license, the first statement in the license would state that the plant will meet the current requirements in effect.

If things change, if seismology, new things come up, and it applies to that -- it applies to Unit 1 or it applies to Sequoyah, or any other plant, would also be applicable to Unit 2, and it would require, under the license, to follow those requirements.

CHAIR RAY: Well, that is basically what I think I said, as well.

It's just that if I were writing the SER, I would have said so.

MR. RAGHAVAN: True, but we're looking at the -- they're evaluating Unit 2, to --

CHAIR RAY: All right.

MR. RAGHAVAN: -- to meet the current NRC requirements.

CHAIR RAY: All right, but it's just so terce and so limited, in what it says, given what's in play today.

As I say, you've got a generic letter out. You've got 191 that's been sitting around for two years, and I would have simply made note that this would be handled, as part of an operating plant, so that it wasn't a blank slate here.

MR. RAGHAVAN: Yes.

CHAIR RAY: Okay, go ahead, Patrick.

MR. MILANO: Okay, if there are no more questions, I'm going to turn over the floor to Mr. David Stinson, who is the Vice President of TVA for Watts Bar Unit 2.

MR. STINSON: Good morning, Mr. Ray.

CHAIR RAY: Good morning.

MR. STINSON: It's a pleasure to be here. I thought we'd kind of just piggy-back on the question you asked about where we are with the open items, to give you our perspective on those.

This is something that we are actually, just obviously, quite concerned about. Every Tuesday at 3 o'clock, we start out -- start off a status meeting with review of the open items that are there.

I can tell you, I'm going to give you kind of approximate numbers, that 80 percent of those open items, we have submitted documentation on those.

Ten percent have either testing or completion of construction, that will then follow on with a submittal, and there are 10 percent we've yet to answer.

So, you know, in that result there, we feel like we're about, you know, 80 percent complete, with a clear path to get to the rest of them.

CHAIR RAY: Well, you'll appreciate our problem, which is that we need to go beyond, at least in some areas that are of interest to the ACRS members, simply acknowledging that you have made a submittal and then later on, that it's been accepted by the staff.

We're suppose to independently review what we think is a resolution, a lot of times, and that's quite obscured, as it stands today.

So, just recognize that. It may end up later on, with us having to scramble around, if time becomes compressed, later on, and that's sufficient, I think, for now.

MR. STINSON: Okay, very good. So, today, we have six topics to go over -- five topics, I'm sorry.

Bob Bryan, to my right, will take care of reactor fuels and transient analysis at Chapter 4 and 15.

Penny Selman will go over Chapter 2.4, hydrology, quite a bit, the information to provide to you, and then this afternoon, we'll be having the WINCISE and cyber security presentations, and Steven Hilmes will do WINCISE and Laura Snyder and Steven

Hilmes will follow up with cyber security.

CHAIR RAY: Thank you.

MR. STINSON: So, unless there are any other questions, we'll start into the reactor fuels discussion.

MR. BRYAN: Good morning. Bob Bryan, representing licensing at Unit 2, talk about fuel.

The focus of my presentation is basically to describe where Unit 2 is, and mention the similarities and differences with Unit 1.

Unit 2 is going to start up with the Robust Fuel from Westinghouse, as compared to Unit 1 at the time of license, they started up with a VANTAGE 5H.

Unit 1 has currently transitioned completely to the RFA-2 fuel, like similar to Unit 2.

One change that we had made recently in Unit 2, will start up with this -- we've added an enhanced debris filter on the bottom that does two things.

One is it helps limit the amount of debris that you could potentially get into the fuel during normal operation, but it's also designed to be consistent with the updated sump screens that we have, so that the ECCS train flow path is consistent with the license.

The cladding is -- has gone from Zircaloy 4 to ZIRLO.

The Unit 2 initial core is very, very similar to the Unit 1 core, in terms of the regions and enrichments. We will rather quickly transition, though, into a low leakage core pattern, as we get burn-up on the fuel.

The major differences, relative to the fuel for Unit 1 is, is we don't currently have tritium in the core and there are no current plans to use tritium-producing rods.

One change to Unit 1 that was associated with tritium, though, was we increased the refueling water storage tank boron from about 2,200 parts per million to 3,000 parts per million.

Unit 2 will run those same boron limits, to try to keep the operational differences to a minimum.

The other major difference is, and we're going to talk about this in some detail later, is that Unit 2 starts up with a fixed in-core detector system.

We have one sort of outstanding generic industry issue on thermal fuel conductivity. This is a -- experiments and data indicate that as burn-up increases on the fuel, the thermal conductivity decreases.

This isn't an issue for the initial core, since there is no burn-up on it. We're going to have a license condition that will follow the industry approach on this, and we've got a -- and you can handle it with margin that exists in the analysis.

That really concludes my presentation on the fuel, unless there are any questions.

CHAIR RAY: No, I don't believe we have any, there. Please proceed.

MR. BRYAN: Okay, then we'll go into the transient analysis in Chapter 15.

The Unit 2 is analytically very similar to Unit 1, with a couple of -- the biggest difference is, is Unit 1 replaced their steam generators and Unit 2 is starting up in -- with the original steam generators.

Replacement steam generators have a larger water volume. They have more tubes in them, so, that makes some minor differences, in the way the analyses look.

The other issue is, is that the start-up, we haven't done the flow measurement uncertainty recovery. So, we're running with the two percent flow uncertainty on Unit 2.

The large-break LOCA and small-break LOCA analyses have very large PCT margins. There is, once again, a difference here, in that Unit 2 is starting up with the best estimate, using the ASTRUM methodology and Unit 1 currently still uses the Appendix K SATAN and BART/BASH, and there are some plans for Watts Bar to, one, to transition to a best estimate, but currently, those are a difference, and you see that in about -- there is about a 300 degree benefit to Unit 2 versus Unit 1, because of that.

There were several analyses that were done for Unit 2, that were not done for Unit 1. The first one was for the loss of load, the transient used in Chapter 15 considered the second safety grade trip.

Typically, the second trip is used to size the safety relief valves, and that's handled in Chapter 5 of the FSAR, and then when you get over into Chapter 15, you do it, where you do a typical analysis, where you use your first safety grade trip.

In this case, we went in and took credit for the second trip, which was an over-temperature delta T versus high presurizer pressure.

Second analysis that is unique to Watts Bar Unit 2 was, we did a CVCS malfunction, where you're looking at either an isolation of let-down or the start of a second charging pump, and what you're looking for here is to see that you don't overfill the presurizer.

Watts Bar Unit 1 treated this as a sub-set of the inadvertent SI event.

Then on main steam line break, this isn't exactly new analysis, but we did quite a bit more parametric studies on reactivity and shutdown margin that were incorporated into the analysis, than what was done for Unit 1.

Then for the --

CHAIR RAY: We saw that, I'm sure. It never was absolutely clear to me, although there are differences, and you've touched on some of them, what led to the -- this large amount of additional work that you're describing?

MR. BRYAN: Well, TVA does their designs in a relatively conservative manner, compared to a lot of people, and we have higher shutdown margins that run typically with higher shutdown margins, than what many of the Westinghouse plants do.

And so, the way that played out was, we had very small return to power, and much lower return to power for the larger steam line breaks than was typically seen in a Westinghouse plant.

CHAIR RAY: Yes, I saw that, and it had to do, though, with a point in line that would --

MR. BRYAN: Right, and so, these analyses were to provide additional back up that -- that if you looked at the range of parameters, you would see a behavior that looked more like what was typically seen.

CHAIR RAY: Yes, that is how it turned out, and then after you did the additional work, okay.

MR. BRYAN: Basically, it puts more conservatism in the analysis.

Inadvertent SI -- excuse me, yes, the inadvertent SI or inadvertent ECCS, in the original analysis, what TVA did was, was they -- they did not model the PORV's, and we felt like that was a conservative thing, because you didn't take credit for anything going out of the PORV, and reducing the rate at which the presurizer would fill.

In terms of liquid releases, out of the PORV, the case for Unit 1 was, was if you got such a release, you could close the block valve, which was designed to deal with a liquid release, and that would terminate it.

We went and re-ran these and showed by

analysis, that you don't get a liquid release out of the PORV for Unit 2.

CHAIR RAY: Therefore, you don't have a small break LOCA?

MR. BRYAN: Right, and for boron precipitation, TVA for Watts Bar started very early on, and reset their hot-leg switch over times to three hours, to preclude any likelihood of getting boron generate concentrating in the core for a cold-leg break.

These sets of analyses were done with adding more conservative assumptions on the back end of the transient to look at the window in which the operator had to complete the action.

In the original analyses, you had about three and a half hours to do it in a very, very conservative analysis. The operator still has an hour to make that, before you would see any boron collection in the core.

We still have an open analysis on boron dilution. The way Unit 1 was done was, explicit analyses were done in Modes 1 and 2. Mode 6 was handled by procedures that isolate the dilution paths and then, it was considered that 1 and 2 were the limiting cases and you had operational procedures that gave you high shutdown margins for Modes 3, 4 and 5.

We've been requested to do explicit analyses for Modes 3, 4 and 5, to show the times, and that is -- those analyses, we're still working on.

CHAIR RAY: Okay, that was going to be one of the questions I asked. So, that will come in, in response to an open item?

MR. BRYAN: Yes.

CHAIR RAY: Okay.

MR. BRYAN: And it should be completed for the December meeting.

CHAIR RAY: Okay, let me just ask TVA then, if you'd make sure we touch on that, at that meeting.

MR. BRYAN: Okay.

CHAIR RAY: We have trouble keeping track of all of the open items, tracking sometimes.

MR. BRYAN: If there are no more questions, that completes my presentation.

CHAIR RAY: All right, very good. Thank you.

MS. SELMAN: Good morning Mr. Ray and members of the ACRS. I am Penny Selman with Tennessee Valley Authority Design Engineering, and I'm here to give you an update on hydrology FSAR Chapter 2.4.

CHAIR RAY: Are you going to explain to us what sand baskets are?

MS. SELMAN: Yes.

CHAIR RAY: Okay.

MS. SELMAN: To give you a little bit of background information, Watts Bar is designed in accordance to Regulatory Position 2 of Reg Guide 1.59, Revision 2, August 1977, and as an alternate to all safety related systems, structures and components being hardened for flood protection, our design and licensing basis assumes floods and combination of potential seismic dam failures and lesser floods exceed plant grade.

There are protective measures that are in place, to assure the protection of the public health and safety, in the event the flooding exceeds the plant grade.

CHAIR RAY: Excuse me, but you're referring to plant grade. Do you not have any safety structure systems or equipment that are below plant grade, and would be vulnerable to flooding at some lower level than plant grade?

MS. SELMAN: Well, we do not, for flood, rely on those underground --

CHAIR RAY: Okay, I was thinking, I don't have the -- have been to the plant, but I don't have it that well in mind, and I didn't know if there were pump switch gears, ultimate heat sink connections, whatever, that would fly below plant grade.

MS. SELMAN: No, everything that we need for flood measures is above flood grade.

CHAIR RAY: All right.

MEMBER STETKAR: And is the auxiliary feed water system below plant grade?

MS. SELMAN: Well, I'll address --

MEMBER STETKAR: Just yes or no, please.

MS. SELMAN: It's below, and we use an alternate for the aux feedwater.

MEMBER STETKAR: Thank you.

CHAIR RAY: Okay.

MS. SELMAN: TVA utilizes the results from the updated hydrology calculation for the Bellefonte COLA, as Mr. Milano previously alluded to.

The February 2008 NRC inspection identified concerns. That calculation has been used as a basis for UFSAR Section 2.4 revisions.

Watts Bar initiated those revisions in 1998. We had an original analysis PMF elevation of 738.1. Our grade elevation is 728.

The 1998 PMF analysis results were about three feet lower, and we changed the FSAR to reflect that to 734.9.

MEMBER BROWN: PMF is what? I forgot.

MS. SELMAN: I'm sorry, probable maximum flood.

MEMBER BROWN: Okay, thank you.

MEMBER STETKAR: Which is not probable nor necessarily maximum, so, it's just an acronym.

You'll find there are several PMF's referenced in the document.

MEMBER BROWN: Yes, there is a number of different numbers.

MEMBER STETKAR: Yes.

MS. SELMAN: TVA initiated the hydrology project in March 2008, and as part of that, we validated and verified our legacy hydrology software, which is simulated open channel hydraulics, or SOCH, and we have verified and regenerated all model inputs, including unit hydrographs, dam rating curves, channel geometry, storm selection, run-off, in-flows and the calibration of the model.

For Watts Bar, the hydrology product produced the following outputs. We regenerated the probable maximum flood for streams and rivers, and supports FSAR Section 2.4.3.

We also validated -- reran potential seismic dam failures. This is combinations of dam failures with smaller floods, to support FSAR Section 2.4.4.

We completed the warning time assessment to support the Reg Guide 1.59 regulatory position 2, and for FSAR Section 2.4.10, for flood protection requirements, and also as part of the project, we validated that through use of the SOCH code, that the loss of downstream dam, for low water considerations, was still adequate in FSAR 2.4.11.

This slide is schematic of the Tennessee River system, and it gives a perspective of the location of Watts Bar within the system and its upstream dams.

The major tributaries to Watts Bar is Norris, Cherokee, Douglas and Fontana. The Cherokee and Douglas come together to form the Tennessee River, right up above Fort Loudoun Dam, which is directly above Watts Bar.

I do have, if you're interested in looking at it, I have a map of the Tennessee River system, as it is physically in the Tennessee Valley, to the right here.

CHAIR RAY: I think the schematic will

suffice.

MS. SELMAN: Okay, okay

MEMBER RYAN: Did you consider multiple dam failures?

MS. SELMAN: Yes, we did.

MEMBER RYAN: Okay, for each one?

MS. SELMAN: Yes. Well, I've got a slide on it.

MEMBER RYAN: Okay, it's coming up, fine.

MS. SELMAN: Yes.

MEMBER STETKAR: Chattanooga is right below Chickamauga, right?

MS. SELMAN: That is correct.

MEMBER STETKAR: I mean, like right below Chickamauga?

MS. SELMAN: Right below Chickamauga, yes.

MEMBER STETKAR: Okay.

MS. SELMAN: Excuse me. Analysis results, our PMF, updated PMF elevation is 738.8, which is an increase from the original analysis of 738.1.

We recalculated the wind wave, and the average wind wave is around 2.5 feet, and that previously was two feet.

The potential seismic dam failures with lesser floods is -- the highest ones are the ones shown here, but we did several --

MEMBER STETKAR: Before you get into the seismic.

MS. SELMAN: Okay.

MEMBER STETKAR: I'm curious, back on slide number 10, you said the original analysis estimated a PMF elevation of 738.1.

MS. SELMAN: Yes.

MEMBER STETKAR: You redid the analysis, extensively using improved data and methods, in 1998, and managed to reduce that to 734.9.

MS. SELMAN: Yes.

MEMBER STETKAR: Now, you've redone the analysis and managed to get it back up to 738.8. What is happening? I mean, why -- what in those analyses of the PMF --

MS. SELMAN: Yes.

MEMBER STETKAR: -- is making four foot elevation changes at the site?

MS. SELMAN: When we redid in 1998, I will say that we didn't do a full model redo. We just -- we had made some dam safety modifications throughout the Valley, and we put those into the model that we had, and reran it, and that produced the three feet less results.

Gordon, if you could go ahead one, two slides.

MEMBER STETKAR: That's okay, if you're going to get to it, that's fine.

MS. SELMAN: Okay.

MEMBER STETKAR: Back up, I'm sorry, I was just curious.

MS. SELMAN: So, for the potential seismic dam failures with lesser floods, what we've shown here, I'm just showing you the top -- the highest elevation producing floods and seismic dam failures.

But we did -- we redid several. There is no one single dam failure that will exceed plant grade, at Watts Bar. It's a combination of the ones shown here.

If you have an SSE plus a 25 year flood, for Norris, Cherokee, Douglas and Tellico, you get an elevation of 731.1, but it is bounded by the PMF elevation. PMF elevation is still -- is controlling.

MEMBER STETKAR: I see a lot of pictures coming up. When is an appropriate time to ask you about specific dams, now, or should I wait?

MS. SELMAN: If you could wait.

MEMBER STETKAR: I'll wait.

MS. SELMAN: Okay, and the OBE and half

PMF, a failure of Norris and Tellico dams, provides an elevation of 728.8 at Watts Bar, and I will say that in most of these cases, we did not do detailed analysis of the dams. We assumed failures of the dams.

So, we're not saying that our dams are not safe. We are just postulating failures for this analysis.

CHAIR RAY: But the failures assume a certain size breach, a certain release rate, I believe, is that correct?

MS. SELMAN: That is right. They -- these are full failures of the concrete. The embankments during a seismic event, are stable.

CHAIR RAY: Okay, so, that's how the size of the breach is defined, it's by the portion of the embankment that is concrete, and therefore, subject, presumably, to seismic failure?

MS. SELMAN: Yes, yes. Next slide, please. Continuing with analysis results.

For the warning time assessment verification we validated that we still had 27 hours, as we had previously -- for warning time, for Watts Bar Unit 1, and we relooked at summer and winter storms, for the PMF, with rainfall and the -- a large amount of rainfall occurring on the last day.

We looked at the seismic dam failures with the smaller floods, and actually, the shortest arrival time is from a dam failure, it's actually from OBE failure of Norris and Tellico, in the half PMF with an arrival of 28 hours, and that is an arrival at a foot below plant grade.

So, 727, we allow an additional foot for wind wave, in preparation.

MEMBER BROWN: Could I ask a question? This is for information.

MS. SELMAN: Yes.

MEMBER BROWN: In this previous slide, you talk -- I see the two elevations for the flood. I presume those are the maximum flood levels, and since you're above that grade, you won't be inundated with water. Is that the -- you won't be buried.

MS. SELMAN: No, we are below --

MEMBER BROWN: I'm trying to understand --

MS. SELMAN: We're below the --

MEMBER BROWN: I'm not a hydrology person.

MS. SELMAN: Yes.

MEMBER BROWN: So, I'm just trying to understand, from the previous slide, where you said the flood grade for you was 738. You got it back up to that, if I'm understanding what the terminology means, and then I see what I think I thought I read on page 13 was that the flood levels, 25 year, the maximum height or elevation would be 731, which is eight feet below, getting into the plant? Is that what that means?

MS. SELMAN: Well, no, no, it's not.

MEMBER STETKAR: It's three feet above getting into the plant.

MEMBER BROWN: Okay, all right.

MS. SELMAN: The grade, the plant grade at Watts Bar is 728. So, we are a wet site. We are designed as a wet site.

MEMBER BROWN: Okay, where was that?

MS. SELMAN: That is what I talked about in the beginning.

MEMBER BROWN: Okay, I missed that. I apologize for that.

MS. SELMAN: Yes, the reg position 2.

MEMBER BROWN: Okay.

MS. SELMAN: That we assumed in our design.

MEMBER BROWN: Okay, now, I've got it. I've got that.

MS. SELMAN: Okay.

MEMBER BROWN: So, now, the warning time, what does that mean? You've got time to put the sand bags up, or what?

MS. SELMAN: That means that --

MEMBER BROWN: I don't know what a wet site means.

MS. SELMAN: Okay, so, that means that we make preparations for the flood, that we'll -- a lot of the safety related systems, structures and components will abandon, and we use -- like we use high pressure fire protection to -- we dump that into the steam generator for cooling the steam generator, and we use ERCW to provide component cooling system water.

So, we take --

CHAIR RAY: What chapter is all of this described in? It's not obviously, here.

MEMBER STETKAR: It's 2.4.

MS. SELMAN: It's 2.4.

CHAIR RAY: It's in 2.4?

MS. SELMAN: It's 2.4.10 or 11.

CHAIR RAY: Okay.

MEMBER STETKAR: Yes, 14 is the mitigation sort of activities.

MS. SELMAN: Yes.

MEMBER BROWN: So, by dumping all this stuff, filling up the steam generators and having this other system lid off, I mean, I presume you have to have electricity for this ERCW system to operate.

MS. SELMAN: Yes, and we assume diesel generator.

MEMBER BROWN: And those are above the flood level?

MS. SELMAN: Yes, they are.

MEMBER BROWN: And all the power sources and the switch gear are above the flood levels?

MS. SELMAN: Yes.

MEMBER BROWN: Okay.

MEMBER STETKAR: Penny, as long as -- are you finished?

MEMBER BROWN: Well, I don't know whether I am or not.

MEMBER STETKAR: Let me ask, since Charlie is asking about elevations, and I didn't -- are you going to talk something more about the equipment and those mitigation actions?

MS. SELMAN: I had not --

MEMBER STETKAR: Okay, let's talk about it now.

MS. SELMAN: Okay.

MEMBER STETKAR: The plant intake building, whatever it's called, pumping building -- where the ERCW and fire pumps live, that will be flooded below grade.

I understand that the ERCW pump motors and the fire pump motors are -- I think they're 742 or something like that.

MS. SELMAN: Right.

MEMBER STETKAR: So, they're above flood level. What -- it's mentioned in the FSAR, that there are -- there is electrical equipment below grade in that building that will be flooded. What is that electrical equipment?

MS. SELMAN: I'm going to have to defer to Steve Smith, please.

MR. SMITH: Steve Smith, operations at Watts Bar, TVA.

At the intake pumping station, we have the ERCW pumps, the high pressure fire pumps, raw cooling water pumps, and the raw cooling water pumps is the non-safety related secondary site cooling supply water, and its electrical distribution is located in the bottom of that, for the raw cooling water system.

MEMBER STETKAR: Everything electric for ERCW is located --

MR. SMITH: Is located in the plant.

MEMBER STETKAR: In the plant, okay.

MR. SMITH: That's correct.

MEMBER STETKAR: Okay, what about -- I didn't have a chance to go back and look in Chapter 9, and I couldn't -- actually, I did look, but I couldn't find details.

Are there things like traveling screens and flushing water systems for the intake of ERCW?

MR. SMITH: Yes, the ERCW intake traveling screen motors are above grade plant elevation as the ERCW pumps.

MEMBER STETKAR: Okay.

MR. SMITH: The strainers that support the water coming to the plant are below grade. The non-safety related part is turned to the drum, the motor on it. The flow path through the strainer is available --

MEMBER STETKAR: Now, my question -- all right, thank you. I'm glad you said that, because my question is why will the flow path through those strainers be available if the drums aren't turning into clean strainers, in an accident that involves a very, very severe flood that has, entrained in the river now, just more debris than you have ever thought about in your entire life, of varying sizes and consistencies anywhere from buildings to all of the silt that comes down many, many --

MR. SMITH: I was just speaking from an operations perspective. I guess the design has to do that, so, they'll probably have to answer that another way.

My thought is, the silt stuff, it lays on top of the water, and where we take the suction is below --

MEMBER STETKAR: My thought is that the entire flow would be full of, I'll use a technical term, gook.

I've seen floods, and it doesn't seem to be a nice stratified water situation, with things floating on the top serenely and box sitting on the bottom. It tends to be kind of a mess.

So, I'm curious about why the intake for ERCW, if it has screens, won't just plug up solid, if there's no way of cleaning those screens?

MR. SMITH: The screens have screen wash pumps and the motor turns the screen, and those will still be above grade and safety related power is above grade.

MEMBER STETKAR: I thought you said that

the --

MR. SMITH: There's a strainer down stream of the pumps, that takes the smaller sediment out, that the screens don't get.

MEMBER STETKAR: And the down stream one will be under water?

MR. SMITH: Correct, the pipes go underground from the IPS to the plant.

MEMBER STETKAR: The discharge side of the ERCW, that would be --

MR. SMITH: That is correct.

MEMBER STETKAR: -- would be underwater, but not on the suction side?

MR. SMITH: That's correct.

MEMBER STETKAR: Okay.

MR. SMITH: The intake itself --

MEMBER STETKAR: I'm sorry, I misunderstood you.

MR. SMITH: Okay.

MEMBER STETKAR: I thought that there was a rotating screen --

MR. SMITH: I apologize.

MEMBER STETKAR: -- on the intake side that was underground.

So, all you're doing is missing, perhaps, the discharge side screening of ponds?

MR. SMITH: Correct.

MEMBER STETKAR: Okay, thanks. That helps.

MR. SMITH: Okay.

MEMBER STETKAR: Diesel generator building, where are the diesel --

CHAIR RAY: Before you go to diesel generator building, can I ask a question that's related to --

MEMBER STETKAR: Yes, if it's the same building, sure.

CHAIR RAY: Well, I think so. I understand how we get water into the secondary side of the steam generators and to the reactor plant cooling water supply. John just talked to you about that.

How do you maintain the parameter system inventory?

MR. SMITH: There is different modes of cooling, whether you're open mode or closed mode.

The spent fuel pit cooling system, which have pumps and power supplies that are above the flood grade, is you recirc through the spent fuel pit, through the heat exchangers that are normally used for the residual heat removal system, to the core and then back to the spent fuel pit, circulate around that.

The spool pieces and other equipment we install in this preparatory time, align all of that up.

CHAIR RAY: It's just, this is after cooling down and de-pressurization?

MR. SMITH: Yes.

CHAIR RAY: Okay, so, the time from notification until the event arrives that you go through a -- you go down to mode 3 and --

MR. SMITH: Actually, in mode 5 or 6 --

CHAIR RAY: Five or six?

MR. SMITH: -- those reactor head -- if the head is on the vessel, then we use the steam generators and the high pressure fire protection system to feed the steam generators on a natural circulation to cool them.

CHAIR RAY: Yes, what I'm concerned about is natural circulation with the -- RCS pressurized, and how you're -- what you're assuming about the RCP seals, for example, since you don't have high pressure injection.

Do I understand that you -- that that's not a mode you would find yourself in, because you would de-pressurize?

MR. SMITH: That is how the procedure is set up, yes, sir.

CHAIR RAY: Okay, John.

MEMBER STETKAR: I'll ask Penny, because she's up front with it.

The diesel generator building, where are the diesel fuel oil transfer pumps located, pumps that fill the day tank from the fuel storage tank? Are the below grade?

MS. SELMAN: Steve?

MR. SMITH: Yes.

MEMBER STETKAR: Okay, how can you --

MR. SMITH: Can I clarify, just a second?

MEMBER STETKAR: Sure.

MR. SMITH: The -- we've got seven day tank that's located at the diesel building pump grade, that has pumps that are above grade, that transfers from the seven day tank to the day tank on the diesel generator.

Large fuel storage tanks are located where --

MEMBER STETKAR: Okay.

MR. SMITH: -- that would be below grade.

MEMBER STETKAR: But everything for seven days is completely above grade?

MR. SMITH: That is correct.

MEMBER STETKAR: Great, thank you. That helps a lot.

MR. SMITH: Okay.

MEMBER STETKAR: Well, since I'm on a roll here, with sort of equipment, because I know you want to talk about hydrology and dam failure. So, let's consolidate a lot of these things.

Spool pieces for connections from ERCW to auxiliary feedwater, are they below grade the spool piece locations?

MR. SMITH: That's the high pressure fire protection?

MEMBER STETKAR: I'm sorry, high pressure fire protection, ERCW --

MR. SMITH: They are above, the spool pieces are above grade. The elevation, 737 is the walking elevation that you're on.

MEMBER STETKAR: Okay.

MR. SMITH: But the spool pieces themselves are several feet above that release valve.

MEMBER STETKAR: The auxiliary feedwater flow control valve is up there also?

MR. SMITH: They're on that same elevation.

MEMBER STETKAR: Same elevation?

MR. SMITH: On a mezzanine above that.

MEMBER STETKAR: What gets flooded there, just the AFW pumps down below?

MR. SMITH: Yes, the AFW pumps are above grade.

MEMBER STETKAR: Okay, I had one more on that. I'll stop at the moment. Thanks.

MS. SELMAN: Okay, all right.

MEMBER BROWN: Can I ask, John and Harold, you all probably know this, but I don't.

For these plants, is 27 hours enough time to take it from normal operating conditions down to complete cool down?

MS. SELMAN: We have validated, as far as Watts Bar Unit 1, that that -- that all of the flood-mode preparations can be completed within that time frame.

MEMBER BROWN: Okay, including the cool down to whatever the mode?

I'm not familiar with all the -- I'm Naval nuclear background, so, all the modes, I kind of lose track of them, after a while.

So, what mode do you cool down to, and how long does it take to do that?

MS. SELMAN: Steve?

MR. SMITH: To give you specifics, I'd have to have a procedure to give you exactly how high level the -- if you're in the mode for refueling and reactor vessel head is removed, and the spool pieces are installed to use the spent fuel pit cooling system, you recirc through the residual heat removal heat exchanger and the spent fuel pit heat exchangers, to keep the core cool. It's called open mode cooling.

Closed mode cooling with a head-on would be the high pressure fire protection, feeding the steam generator with natural circulation and the -- well, of course the steam generator and the atmospheric release on the steam generator is controlling the temperature and the RCS.

MEMBER BROWN: So, you're just feeding and bleeding, in order to maintain cooling?

MR. SMITH: That is correct.

CHAIR RAY: But natural circulation -- are you talking about natural circulation with the RCS de-pressurized?

MR. SMITH: No, sir, at normal operating temperature and pressure, mode 3 --

CHAIR RAY: Yes.

MR. SMITH: Then your pressure -- I'm

sorry, go ahead.

CHAIR RAY: Well, I thought you said no, you would be down at mode 5, when you activated this -- this condition that you were just describing.

You're talking about -- I understand feed and bleed, and natural circulation --

MR. SMITH: Yes, sir.

CHAIR RAY: -- but I do that with the reactor cooling system pressurized and in that mode, I'm interested in knowing how do you then maintain RCS level?

You don't have high pressure injection and your reactor coolant pump seals are not being cooled.

(OTR comments)

MR. HILMES: Steve Hilmes. What we do is we maintain the thermal barrier on the RCP's, using ERCW with the spool piece and the CCS, to protect the seal, and then as far as make up --

CHAIR RAY: Can I -- let me stop you right there.

So, you've got leak off passed the seals, but you're -- it's sub-cooled, because you've got a cooling supply to the seal?

MR. HILMES: That is correct.

CHAIR RAY: So, it would be like a limited leakage seal, instead of an injection seal?

MR. HILMES: You don't expect the seal to fail, essentially, because you're keeping cooling on the seal, okay?

CHAIR RAY: Yes, okay, no, now, I'm with you.

MR. HILMES: Okay?

CHAIR RAY: At least I'm with you, in terms of what you were saying.

MR. HILMES: Okay, now, for a make up, for that, we have flood oration pumps. Those are above elevations with tanks up on the refuel floor, and they're high pressure injection pumps that make up for that small leakage.

CHAIR RAY: Yes, okay. So, you're taking credit for the pump seals maintaining their integrity and the leak-off, the small leak-off, you can make up for that?

MR. HILMES: Yes, we have relatively small pumps, but they have to make that up.

CHAIR RAY: Yes, okay.

MEMBER BROWN: How long can you do this, this cooling operation, with --

CHAIR RAY: Well, they can do it --

MEMBER BROWN: I mean, is it --

CHAIR RAY: -- indefinitely.

MEMBER BROWN: I mean, they've got enough water -- well, they're blowing water off?

CHAIR RAY: Off the secondary side, they're injecting fire water, with the high pressure --

MEMBER BROWN: And there is enough to go for days? Weeks?

CHAIR RAY: Yes.

MEMBER BROWN: Months?

MR. HILMES: It's river water.

MEMBER BROWN: It's river water?

MR. HILMES: Yes, sir.

MEMBER BROWN: Okay.

CHAIR RAY: Right.

MEMBER BROWN: Right, you'll have to do your water cooling?

CHAIR RAY: Yes. Yes, the tricky thing is the reactor coolant pump seals, but that's all right. At least I understand what they're assuming. Penny?

MS. SELMAN: Okay, loss of the downstream dam verification, we verified that there is adequate time available to produce release from the upstream dam, Watts Bar dam, to provide sufficient elevation for cooling.

We did two cases. We did no discharge from Watts Bar dam and there is 27 hours to critical elevation 666.

We also did an evaluation of discharge from upstream dam, starting at the same time as loss of downstream dam, and also, starting at 12 hours after loss of downstream dam.

The discharge from the upstream dam is -- it can be -- the elevation of 666 can be maintained starting at 12 hours after dam failure of Chickamauga dam, downstream dam.

MEMBER STETKAR: Penny, not yet.

MS. SELMAN: Okay.

MEMBER STETKAR: Several questions on Chickamauga.

You mentioned that you did an analysis to show that it was -- I forgot, how long did you say to get down to 666?

MS. SELMAN: Twenty-seven hours.

MEMBER STETKAR: Twenty-seven hours?

MS. SELMAN: Yes.

MEMBER STETKAR: That analysis was done during summer conditions, where you had maximum level in the reservoir.

What is the time during winter conditions, when you're down at low level and -- in the reservoir?

MS. SELMAN: Greg, do you -- can you speak to that question?

MR. LOWE: Greg Lowe, TVA contractor. Actually, both conditions were looked at and in either case, the cooling level change between winter and summer at Chickamauga is not that large. It's a matter of a few feet, because the difference in winter and summer on a pool that maintains navigation. So, it was very little fluctuation.

MEMBER STETKAR: It's about seven feet?

MR. LOWE: Yes, it's -- that is at maximum, yes.

MEMBER STETKAR: Okay, all right.

MR. LOWE: And even with the lower level, the time available to -- before you reach that critical level and the opportunity to release on the upstream project, did not present a problem in that case, as well.

MEMBER STETKAR: I'm not asking whether it's a problem. I'm asking what the time is.

MR. LOWE: I don't recall the --

MEMBER STETKAR: Okay, let's take a -- I want to know what that time is.

Twenty-seven hours is a magic number,

here. Everything is magically 27 hours or greater.

If something is less than 27 hours, I want to understand how much less --

MS. SELMAN: Okay.

MEMBER STETKAR: -- than 27 hours it might be.

MS. SELMAN: All right, take that out for you.

MEMBER STETKAR: So, I'd like that number, please.

MS. SELMAN: Okay.

MEMBER STETKAR: Chickamauga dam, if that dam fails catastrophically, it's not a good day in Chattanooga, Tennessee.

MS. SELMAN: Correct.

MEMBER STETKAR: It's a really bad day in Chattanooga, Tennessee. It's probably the worst day Chattanooga, Tennessee has ever seen in their lives.

Are emergency responders in Chattanooga, Tennessee going to be real happy with people releasing a lot of water from the Watts Bar dam, to come down and yet, flood their city more?

MS. SELMAN: I don't know if I can answer that question.

MEMBER STETKAR: Okay, well, I'd like an

answer to that question, because in a real dam failure situation, I'm an emergency responder in Chattanooga, Tennessee.

I suspect the last thing I might want to have is Tennessee Valley Authority releasing 3,200 cubic feet per second of water from their dam, to come down the river and make my life even more miserable for me.

So, I'm curious how you've coordinated these nuclear plant specific recovery actions in the little world of the nuclear power plant, compared with regional emergency planning actions in the event of a downstream dam failure.

MS. SELMAN: Yes, sir. Greg, can you speak any further to that?

MR. LOWE: I think if I understand your question correctly, the concern is about the failure at Chickamauga.

MEMBER STETKAR: Exactly.

MR. LOWE: And then the resulting release from the upstream dam that would follow, in order to maintain the levels we're talking about here.

MEMBER STETKAR: Right.

MR. LOWE: Is that correct?

MEMBER STETKAR: That's correct.

MR. LOWE: The TVA just basically coordinated, through its Dam Safety Program, and they have an emergency action plan with each of the communities downstream.

So, the emergency management people are already aware and have planning, as to what they would do in different types of emergencies.

So, the release of Chickamauga is going to be so large, with respect to the flow that we would be releasing from Watts Bar, to maintain depth up there, that it would be within the channel anyway, and it's arrival, it's arrival would be well on the back side of the major release at Chickamauga, which is several miles downstream.

So, yes, the community itself would be flooded significantly, by a failure at Chickamauga, major inundation. But a release from the upstream project would be very, very small, relative to that.

MEMBER STETKAR: Relative to that, but it's not zero.

For example, wouldn't there be fairly extensive pressure from emergency responders on TVA to, for example, hold up all water upstream, in your entire integrated dam system upstream, so that I can allow things to dry out and I can get to trapped people and I can repair infrastructure downstream, because although you like to maybe think of things as staying within a well defined channel, I suspect the channel won't be there anymore, downstream of the dam.

I suspect, you know, the entire geography will not look like it does, if you do have that catastrophic failure.

So, I'm curious, you know, whether this assumption that very quickly -- well, not very quickly, in a matter of a few hours, after failure of the downstream dam, in reality, you will establish, you know, substantial flow, small compared to the dam failure, but fairly large compared to, for example, historical low flows in the river system.

You know, 3,200 cubic feet per second is nothing to sneeze at, whether that is realistic, given the realities of the pressure of emergency responders in the city of Chattanooga, to try to keep things as dry as possible for as long as possible, for them to do their work, and you know, are those emergency responders aware of the fact, of these plans, to open up flow from Watts Bar dam for the nuclear plant?

MS. SELMAN: Okay, I understand.

MR. ARENT: So, we have that action?

MEMBER STETKAR: Yes, I mean, it's -- I'm really curious, because this is not -- you know, I recognize that our concern right now, here in this room, is survival of Watts Bar Units 1 and 2, under really severe conditions.

But those really severe conditions are going to affect a lot of people who might have incentives that could be contrary to your incentives at the nuclear plant, in particular, for these flows.

MS. SELMAN: Understood.

CHAIR RAY: Yes, or I guess it can be expressed as, can you -- are you sure, under all circumstances, you can continue to supply cooling water, in the event of this dam failure that you're pointing at here?

MEMBER STETKAR: Well, yes, I mean, will -- will the emergency response infrastructure support that notion?

CHAIR RAY: But I think of it beyond --

MEMBER STETKAR: Because if they can't, if they can't open up --

CHAIR RAY: Yes.

MEMBER STETKAR: -- the flood gates, then --

CHAIR RAY: I understand.

MEMBER STETKAR: -- the river becomes dry.

CHAIR RAY: Right, and so, that's well put, but it's just a matter of can you -- in the absence of that downstream dam, can you maintain sufficient cooling flow to the plant?

The assumption is that you can. You're asking a reasonable question, how do you know it would actually be possible to do?

MEMBER STETKAR: Physically, I know it's possible, it's just, you know --

CHAIR RAY: Well, no, I --

MEMBER STETKAR: Will response to that emergency --

CHAIR RAY: Everything considered is a --

MEMBER STETKAR: -- allow you?

MEMBER BROWN: John, can I just -- I want to -- like Harold, I guess I want to try to understand this, some of this.

If Chickamauga goes, is the concern then that the water level falls so low below the dam, that you then can't get sufficient cooling for Watts Bar?

MEMBER STETKAR: The river drains.

MEMBER BROWN: The river drains, I understand that part.

MEMBER STETKAR: Yes.

MEMBER BROWN: But I want to know how much it drains.

CHAIR RAY: If we have to supply water from an upstream dam --

MEMBER BROWN: So, you drain your -- you open your own to keep that water level high, order to make -- okay.

CHAIR RAY: Which then adds to the effect of the dam failure.

MEMBER BROWN: Yes, absolutely, I got that. Thank you.

MEMBER STETKAR: Are we going to talk more about dams, individual dams?

MS. SELMAN: No.

MEMBER STETKAR: Okay, thanks.

MS. SELMAN: Okay, next slide, Gordon. So, you had asked previously, what caused the increases in the flood level, for the PMF today.

There were three major things that had occurred, that caused the changes.

Over time, river operations had changed the way they operated the river. We had completed a study in 2004, and we raised tributary elevation.

So, your starting elevations were higher in the tributaries.

We also re-assessed operational

allowances. When we were going -- going through all of the validation and verification in the inputs, we looked -- we re-looked at the assumptions that were made about how much you could surcharge the tributary dams.

So, you have the flood come, and we use the tributaries for storage, and we had allowed -- previously, had allowed that surcharge to get up to a level so high, that dam safety was not comfortable with that, and therefore, we changed that assumption.

Also, the spillway coefficients were found to be -- we found that we had used textbook values for the upper reaches of -- for the high levels of flow, for orifice flow, and we actually had some model test data that we had completed at our Norris hydraulics and hydrology lab.

And we had the test data that -- for our specific gates, and we used that data in the updated hydrology analysis.

So, the comment -- that was a major player because it increased the amount of storage behind the dam, because we couldn't get out the -- the flow as fast, as we had previously assumed.

So, as part of that -- the hydrology update and the dam rating curves, the spillway coefficient issue, we had four upstream dams that were increasing in elevation, such that the embankments behind those dams -- at those dams, went over top, and if the embankments overtop, then you are -- you are then assuming erosion and failure of embankments.

So, those four dams, Watts Bar. Fort Loudoun, Tellico and Cherokee, were protected with HESCO bastions or barriers, and these were chosen as they had previous proven reliability during floods in New Orleans, North Dakota, Missouri and Iowa, during the 2008 flood there.

This table just gives you an overview of the new PMF headwater elevations at the four dams, and the new tell-water elevations, that -- where it says 'current elevation', that's actually previous elevation, before raising the embankments with the HESCO barriers, and the new elevation is with the HESCO barriers.

MEMBER BROWN: What does HESCO mean, again?

MS. SELMAN: It's a brand name.

MEMBER BROWN: A brand name?

MS. SELMAN: Yes.

MEMBER BROWN: Okay, thanks.

MS. SELMAN: We raised -- we installed

18,200l linear feet of HESCO barriers on the embankments, and it shows you there, the HESCO -- the number of HESCO baskets used, and the numbers -- amount of sand used.

This is -- I'm just going now into some pictures to show you the location of the sand baskets, the HESCO barriers.

Cherokee Dam, there you see in the red, the area that was -- where the embankments were raised and the little insert picture just shows you, to the left, places that you couldn't see in the big picture, that were also protected.

This is just an up close look of the baskets, and how they --

CHAIR RAY: Did I understand that these are not intended as permanent?

MS. SELMAN: That is correct.

CHAIR RAY: And therefore, there is some plan to replace them or supercede them with something that is permanent?

MS. SELMAN: That is correct. At Tellico, we raised -- we installed 6,011 linear feet of sand baskets, again, along the embankments in the Saddle Dams.

Just another view of the baskets at

Tellico.

Fort Loudoun Dam, Fort Loudoun Dam is a little bit of a -- was a challenge for installation. The -- it went right along the roadway, underneath the bridge, and there is already existing concrete flood wall there, and as you'll see in the next slide, where there is concrete flood wall in the upper left-hand picture, the baskets are sitting against that flood wall, and then we did a double layer to protect up to the needed elevation.

At Watts Bar Dam it's not as visible, there is not a red line, but back there along the roadway, is where the baskets were located.

MEMBER BROWN: Which roadway? The big roadway or the little bitty road, coming in?

MS. SELMAN: Not across the dam -- the bridge, but down near the river, the beach area, yes. Thank you.

MEMBER BROWN: That little blue line?

MS. SELMAN: Yes.

MEMBER BROWN: Okay.

MS. SELMAN: Okay, for Watts Bar Damn, you can tell a little bit in the upper left-hand picture that there were portions under the bridge that we could not put in the sand baskets.

So, next slide, Gordon. So, we allowed overtopping of that concrete wall, but to protect the embankment, we installed Armor Flex concrete mats and to protect -- to harden the embankment, and we covered those with soil and they've since been grassed.

Okay, any questions on the baskets, before I move along?

Okay, also, when we had modified the four projects, we did -- re-evaluated the dam stability of those dams. We had an issue at Cherokee. There were some challenges.

In the simplified analysis, we just did a limit equilibrium or a gravity analysis on Cherokee Dam, and it -- and we also did crack base analysis.

So, there were challenges with the cracked base, but we had sufficient factors of safety for sliding and for over-turning, and the cracked base, what that means is you have some uplift pressures that are putting tension on the hill of the dam, and that -- that was the problem, there.

So, we have -- we are -- right now, ongoing, detailed finite element analysis of Cherokee and also, of Douglas, which is a sister dam to Cherokee, to -- that's the next phase -- step of the dam stability process, is to do the finite element analysis.

Addition protection at Watts Bar Nuclear, we have thermal barrier booster pumps, which we talked about previously, that are required for a flood mode. We currently have margin to protect those pumps, but the elevation of the flood is right near the base -- the pedestal of those pumps.

So, additional margin was desired by the plant and we have -- we are pursuing high temperature reactor coolant pump seals, as a design fix for that.

CHAIR RAY: Okay, well, that was maybe what I was anticipating you saying, when I was asking the question earlier.

You have license condition, and you're going to speak to that at all?

MS. SELMAN: Yes.

CHAIR RAY: Okay.

MS. SELMAN: There is the commitments. We have the -- we have an issue that was raised about the seismic stability of those HESCO baskets.

We committed to do either a hydrology analysis, assuming that the sand baskets fail or to do a seismic test of the baskets.

We have -- we've done the hydrology analysis. It's not complete yet. It's preliminary.

We have preliminary results. The results are adequate, that the elevations at Watts Bar do not exceed the PMF elevation, and the timing is still adequate, but those results are not finalized yet.

We will continue to maintain in the spec, those HESCO barriers until implementation of a permanent solution for all four dams, and the permanent solution is underway. We're got an Environmental Impact Statement notice out, and then we'll -- it's going through the NEPA process.

MEMBER BROWN: How long is that going to take?

MS. SELMAN: It is expected to take three to four years for implementation of the permanent measures.

Then we will -- we also have a commitment to provide an update to the FSAR to describe long-term stability analysis methodology following completion of the finite element analysis of Cherokee and Douglas Dams, by August 31, 2012.

CHAIR RAY: Well, I mean, in -- to say it as simply as possible, I'm not sure exactly how we came to the conclusion about this, given what is outstanding, as you have just summarized here.

I don't expect you can add anything to

what you say. We'll have to talk to the staff about what their views are.

MEMBER STETKAR: Harold, in the sense of -- I have numerous questions, I've been politely waiting for Penny to get through her --

CHAIR RAY: Well, then we should pursue them, definitely.

MEMBER STETKAR: Yes, and I would like to do that, before you finally summarize.

CHAIR RAY: Yes, but I mean, given the -- for example, the dates when some of this stuff --

MEMBER STETKAR: Well, I have more fundamental questions about the analysis --

CHAIR RAY: Okay, go ahead.

MEMBER STETKAR: -- the analysis and the dates for the -- fixing the four dams.

In the FSAR, there is Section 2.4.4.1, and I have to apologize, we only had Amendment 103 available until today. So, I'm trying to quickly check, I don't see any change bars in this particular section, but excuse me, if I misquote.

MS. SELMAN: Okay.

MEMBER STETKAR: For the analysis of Fontana Dam that was done, failure of the Fontana Dam, there are a couple of statements that -- it says that a subsequent review, which takes advantage of later earthquake stability analysis and dam safety modifications performed for the TVA Dam Safety Program has defined a conservative, but less restrictive seismic failure condition at Fontana Reference 40. I couldn't find Reference 40. It may be in 104.

The subsequent review used a finite element model for the analysis and considered the maximum credible earthquake expected at the Fontana Dam site.

Was that maximum credible earthquake different from the original earthquake acceleration that was used, and if so, what is it and what is its frequency and why is it considered the maximum credible earthquake?

MS. SELMAN: I don't have those answers right off the top of my head. I'll have to get back with you on that.

MEMBER STETKAR: Okay, I am interested in that, because it was notable that it was the only that said, you kind of -- it was the only one where this notion of maximum credible earthquake came in, as opposed to the --

MS. SELMAN: Okay.

MEMBER STETKAR: -- there is fairly decent descriptions about epi-centers of earthquakes and expected peak ground accelerations at various other dams, and this one was a little bit different. So, I'm curious about that.

For one of the failure combinations, and this is also in Section 2.4.4.1, it's a long section, the combination of Cherokee, Douglas and Tellico, for the operating basis earthquake when one-half the probable maximum flood, that's just a hook to get you to the right part.

It says that you didn't perform a specific analysis for that combination. It says rather, the results for this combination were taken from the Bellefonte Nuclear Plant analysis.

The primary difference between the Bellefonte Nuclear Plant calculation and that for Watts Bar Nuclear Plant is that the head-water rating curve used at Chickamauga Dam.

For the Bellefonte Nuclear Plant analysis, the future lot configuration, five spillway bays removed, leaving 13 spillway bays, was used, rather than the current lot configuration with 18 spillway bays, and it's concluded that that's conservative.

Is there, in deed, a plan to remove five spillway bays from Chickamauga?

MS. SELMAN: There is a plan in place to install the new lot.

MEMBER STETKAR: Is -- are all of the flooding analyses, say for this one combination, that were performed for Watts Bar, done presuming that you will have 18 spillways at Chickamauga?

MS. SELMAN: Currently.

MEMBER STETKAR: Okay, why were they not redone?

MS. SELMAN: Well, it's in -- in the TVA business plan long-term, to redo those analyses.

MEMBER STETKAR: Why weren't they redone for the licensing of Watts Bar Nuclear Unit 2, because that reduced spillway capacity could affect the actual flood level at the site?

MS. SELMAN: Well, we do have an elevation for those reduced spillway gates, for PMF, but we would -- we did not redo all of the other -- the seismic plus --

MEMBER STETKAR: What is that elevation?

MS. SELMAN: Greg, do you know the elevation?

MR. LOWE: No.

MS. SELMAN: It's, I believe it's 740.4, but I would have to follow up with that.

MEMBER STETKAR: Another foot and a half, okay.

MS. SELMAN: Yes. No, it should only be -- I'm wrong. It's only .6. It's less than a foot at Watts Bar.

MEMBER STETKAR: I'm curious to learn what that is, and I'm really curious about -- the analysis -- if it's going to be done, if it's in the plan, the analysis was done for Bellefonte.

We are sitting in the year 2011 with a fairly extensive re-analysis of the flooding at this site, which is susceptible to floods.

Why wasn't the entire re-analysis redone, using the planned gate configuration at Chickamauga, because releasing water from Chickamauga is pretty important to a lot of these flooding analyses.

MS. SELMAN: Yes, it is.

MEMBER STETKAR: Okay, let's see, we talked about Fontana.

Watts Bar Dam, I had questions about Watts Bar. There is a statement in there, and this is -- I'm curious about this.

This is in Section 2.4.4.1, again. There is a statement that says, re-evaluation was not made for Watts Bar Dam for Safe Shutdown Earthquake conditions. However, even if the dam is arbitrarily removed instantaneously, the level at the Watts Bar Nuclear Plant, based on previous analysis, would be below 728 plant grade.

Does that mean if I vaporize the Watts Bar Dam, I will not flood the site?

MS. SELMAN: That is correct.

MEMBER STETKAR: Okay.

MS. SELMAN: And that's for, you know, 25 year flood elevations, SSE plus 25-year flood. So, your head-water and your toe-waters are much lower.

MEMBER STETKAR: That doesn't apply for the OBE with the half PMF?

MS. SELMAN: The OBE, Watts Bar has been analyzed --

MEMBER STETKAR: Okay, yes.

MS. SELMAN: -- and it doesn't fail.

MEMBER STETKAR: Okay, let me ask you, there are -- I'm trying to phrase this coherently, because there is so much information in that section.

The analyses for Watts Bar and Chickamauga, under the OBE with the half PMF, other members, bear with me, I know it's a lot of jargon.

Presume that the flood gates, if I can call them that, are open fully to deal with the preexisting rain condition. There are statements in there saying, "Failures of the bridge across each dam may occur a the OBE, and the bridge would them impact the open gates, snapping them off, sweeping them downstream."

So, therefore, in effect, the full release capability remains available from those two dams under these seismic conditions. Am I interpreting the analysis correctly?

MS. SELMAN: Greg, would you like to answer?

MR. LOWE: I don't know exactly. I would have to look, to be able to answer.

There are some classes where the collapse of the bridge came down the structure, but I don't have the -- I don't have the --

MEMBER STETKAR: As best as I can make out from the discussion, the OBE events, because they occur in combination with this half probable maximum flood severe rainfall event, it's presumed that the gates are initially opened fully, and that it's presumed that when the bridge fails, it basically clears them out, so that you -- you have full release flow from both of those dams, which is a good thing for the site, and that's pretty clear.

When it got to the SSE analysis, it became less clear, because that analysis is done under the 25-year flood conditions, which are less severe, and there are statements like, "Well, the flood crest would have probably passed the Watts Bar Dam before the seismic event occurred. So, the gates would have been open when the flood crest went through, but the gates would probably be re-closed, and a bridge failure would then affect the gates, and that's conservative."

The implication that I have is that maybe the gates are Watts Bar are failed closed, and the same is true for Chickamauga, but I couldn't quite confirm that. Could you?

MR. LOWE: Not without looking at that --

MEMBER STETKAR: Okay, I'd appreciate that, because again, I'm trying to get into what sort of hydrologic conditions were assumed under these sort of contrived seismic and water conditions at the dams, and what benefit or detriment those flow conditions may have to the flooding analyses that were performed?

MS. SELMAN: Okay.

MEMBER STETKAR: Do you follow me?

MS. SELMAN: Right.

MEMBER STETKAR: You know, conditions that maximize the release rates are not necessarily -- if they're realistic, they're realistic. If they're optimistic, I'd like to understand whether they are.

MS. SELMAN: Okay.

MEMBER STETKAR: Okay, Watts Bar Dam, and this came up in the safe shut-down earthquake analysis that I looked at, there are discussions in there -- well, there are a couple of places where there are discussions about how quickly the gates could be opened at Watts Bar, and the fact that the lift mechanism is normally positioned over one of the gates and that it's powered from the normal buses and that there is a gasoline powered emergency generator that can be connected to the buses to supply power.

Is any of that equipment equally qualified?

MS. SELMAN: I'll have to follow up on that also.

MEMBER STETKAR: So, for example, although you say you have electric power available to open the gates, during any kind of -- of either an OBE or an SSE, will you actually have electric power available to operate that equipment?

MS. SELMAN: I'll have to follow up on that.

MEMBER STETKAR: Data, there is -- the only place that I saw references to data -- I know that you've -- I know that you've updated the PMF calculations, based on Corp of Engineers, you know, updated analyses over the years, I guess.

There is one reference to wind data that are used for assessing the wind driven wave heights that -- something like 2.2 feet, you know, under the probable maximum flood conditions.

There is a reference to data that says, "Well, we really didn't have much data, so, we went to," if I can find the reference here. Don't ever get old, your eyes are the third thing to do. Your knees are the first thing. I don't remember what the second was. Bear with me.

It says, "Records of daily maximum average hourly winds for each direction are available at the Watts Bar site for the period May 23, 1973 through April 30, 1978."

And you say that you compiled wind data at Chattanooga from 1948 to 1974, but because there was minimal or almost zero overlap between these records, there were fairly sophisticated statistical correlations that we used to draw the conclusion that Chattanooga wind data from '48 to '74 was conservative for the Watts Bar site.

My question is, don't we have wind data since 1978 at the Watts Bar site? I mean, it has been 33 years. Don't you have a meteorological tower there that compiles wind data?

MS. SELMAN: Yes, and that is part of the analysis. That -- we took the wind data that we used for Unit 1, and we did not update that.

MEMBER STETKAR: Even though you had a third of a century more of wind data?

MS. SELMAN: Yes.

MEMBER STETKAR: Okay, it would seem reasonable to use that wind data at the site, to estimate wind speeds at the site.

So, you know, this is another example of saying that we're using analyses that are 33 years old and kind of piece-meal updating them without updating all the information that's available at the site in 2011.

Now, I understand a little bit of the seismic stuff, because it's a different issue, but this is meteorology, after all, and you're using updated Corp of Engineers probable maximum flood information that's extensively conservative -- or current. I believe that it's been updated to 2008 or

2009 or 2010, I don't remember the numbers.

I don't know whether it makes a difference, but it would certainly lend an awful lot of confidence, if you said, "I had, you know, 35 years of data from the site," and it takes -- you know, I can pull up data for Chattanooga from 1948 through 2011, from National Weather Service, you know, in a minute.

So, correlation of that data, if you want to go back previous to 1973, for another 25 years, is easy to do.

MS. SELMAN: Okay.

MEMBER STETKAR: It's not very difficult, and I guess in the interest of time, I have other questions.

One question I did have, though, what elevation is the control in?

MR. SMITH: Seven-fifty-five.

MEMBER STETKAR: Seven-fifty-five, yes, I figured it's up pretty high. The discussion in the FSAR says, "Well, it's pretty likely that the flood conditions at the site will remain above grade for, you know, one to four days." I think I remember that range.

Although, you know, you've demonstrated

capability for the flood mode cooling configuration for, you know, at least 100 days. It's certainly a long time from that.

Then the operators have to live in the control room for those four days, because nobody can actually, physically get to the control room?

MR. SMITH: We have boats available that they can use.

MEMBER STETKAR: Okay, so, you're going to rely on boats and helicopters?

COURT REPORTER: Can you speak right into that microphone, please?

MR. SMITH: I'm sorry.

MEMBER STETKAR: Did you pick him up?

COURT REPORTER: No.

MEMBER STETKAR: You want to repeat that?

MR. SMITH: We have boats available for ferrying people in and out.

MEMBER STETKAR: Okay, is that part of the plan or is it --

MR. SMITH: Yes.

MEMBER STETKAR: Okay, thank you.

CHAIR RAY: Well, that's fine, John. I'm trying to formulate in my mind, a way to characterize what we're experiencing here, because I have some of the same difficulty that reflected in your questions.

But I'm going to shift to -- well, I wanted to let you guys make sure we get all of your presentation. How much longer would you expect? We're at this point in the package. What is your expectation, before we get to the security topics, which are at slide 38?

MR. ARENT: The WINCISE -- this is Gordon Arent. The WINCISE topic should probably take us 15 or 20 minutes to walk through, depending on the questions, and then we'll be ready for -- we'll be done with our morning presentation.

CHAIR RAY: You're not planning on having any discussion of other things that are covered in the same SER, such as rad-waste and so on?

MR. ARENT: No, this was the scope of our presentation for today, this and then the cyber security.

MR. MILANO: Mr. Ray?

CHAIR RAY: Yes.

MR. MILANO: This is Pat Milano, again. With regard to -- what the staff decided to do, because a number of the items in Chapters 11 and 12 on rad-waste and -- center around operational dose considerations, and since -- and also in December, we're going to talk about accident dose considerations.

We just -- the staff decided to couple those two, and just talk about operational and accident, all at one time, so we're delaying Chapters 11 and 12 discussions until December.

CHAIR RAY: Well, I saw it wasn't on the agenda, but I didn't know that maybe, it was just -- the agenda had been shortened for convenience.

But it's intended then, to talk about what again, 11 and what?

MR. MILANO: Chapter 11 and 12.

CHAIR RAY: Twelve?

MR. MILANO: Yes.

CHAIR RAY: All right, I've got a question about 9. Can I ask it now, or do I need to do it later?

Nobody is talking about 9. It's in the SER. Is that going to come up later?

MR. MILANO: Actually, we discuss Chapter 9, elements of Chapter 9, two meetings ago. But you're more than welcome to ask questions about it.

CHAIR RAY: Well, what I am looking at here is dated September 2011. So, I guess I'm -- is there anybody from TVA who can discuss the deletion of the -- removal, is the word used here, of the post-accident sampling system from Unit 2?

MR. HILMES: Steve Hilmes. I'll do my best to answer your question, sir.

CHAIR RAY: Well, there is a -- again, I am responding to -- perhaps I should have associated it with discussions months ago, but I am responding to having reviewed this document, issued just a couple of weeks ago.

It talks about -- and I can of course, ask the staff about their view, but I thought since you guys were still here, it would be worth while, asking you.

What the staff says in the SER is, the staff reviewed the acceptability of removing the post-accident sampling system, and then they go into a discussion about how there are contingency plans for obtaining the information that the post-accident sampling system was years ago, required to provide.

And so, I would have questions of the staff, about why they think this is okay, but be that as it may, why did you take it out?

MR. HILMES: There is a --

MR. BRYAN: Do you want me to handle this?

MR. HILMES: Sure, yes.

MR. BRYAN: Bob Bryan. The Westinghouse Owner's Group performed a set of studies that supported taking the post-accident sampling facility out, and it was based on that there was a lot of information that had been developed in the years after Three Mile Island, looking at the instrumentation that we had put in, looking at a number of other factors.

We had incurred analytical techniques for looking at degraded core events, and what you found was, was that you had sufficient, and in many cases, better information and far more timely information from the equipment that you had installed in the plant, than you could get from the post-accident sampling facilities.

And so, so, as part of that Owner's Group effort, a number of the Westinghouse plant -- and others, have taken these facilities out, and as a back-stop for that, we have looked at the availability of other normally installed sample points where you take hot samples, where you can take hot samples and evaluate them, in developing contingency actions to aid you in the recovery.

But the use of the post-accident sampling facility, for making sort of the real-time decisions that you're trying to deal with early in the accident, when decisions are truly critical, are better done with the equipment that we've got, as opposed to trying to get samples to do it.

CHAIR RAY: Okay, well, that, in deed, is -- that never uses the word 'better', but that's fine. I'll accept that. It simply discusses here, the fact that you said that this is a Westinghouse Owner's Group conclusion, that it can be done.

I guess I'll simply wonder out loud, as to whether or not the post-Fukushima analysis is going to continue to validate that being the case, but this is not the place to debate that.

But in any event, it was done pursuant -- as a reflection of that fact that the post-accident sampling system has proven not to be the best way to get the information that you need?

MR. BRYAN: That is correct.

CHAIR RAY: All right, well, like I say, it happens that it was discussed here, in this SER, and although the Westinghouse Owner's Group was certainly referenced as a source of information, it didn't quite say that this was a better way to get the job done. It just said it was an acceptable one, and I wanted to find out if there was some reason why the post-accident sampling system was something you'd like to abandon or get rid of, or not to provide in the plan.

Okay, yes, Dick?

MEMBER SKILLMAN: I would like to ask a question, but Penny is still -- what is the normal pond elevation at the Watts Bar facility, and in the last number of years, there have been cardinal storms in the Northeast, Camille, Agnes, Lee, Irene, Isabel. What did the pond level do for those cardinal -- for those cardinal storms?

MS. SELMAN: Greg, do you have any information on summer pool at Watts Bar?

MR. LOWE: Specific elevation?

MS. SELMAN: Yes, I have some other back up information, but not --

MR. LOWE: Without actually having the particular operating guy here, it's difficult to say exactly what that pool level is.

MS. SELMAN: It should --

MR. LOWE: I think it's seven --

MS. SELMAN: It should be under 600. I've got some other flood elevations here.

MR. BRYAN: This is Bob Bryan. The normal summer pool elevation is 682, and at -- yes, on Chickamauga, which is the flood level -- which is the actual lake that Watts Bar Plant is on.

I think the max summer pool elevation is about 684.

MS. SELMAN: Like the 100-year flood elevation at Watts Bar is 697.

Now, speaking specifically to those storms, I can't, but I can say that they have not been within the 100-year flood elevation.

MEMBER SKILLMAN: Thank you. Thank you to John. I'm new onboard and coming up to speed.

MS. SELMAN: Okay.

MEMBER SKILLMAN: I understand the topic and understand the geography. I was just trying to understand the flood elevation.

MS. SELMAN: Okay.

MEMBER SKILLMAN: Thank you.

MEMBER STETKAR: Did -- I'm assuming -- well, I'll ask, in any of those storms, did you -- because you haven't come close to the 100-year flood, you haven't come close to invoking stage one of the flood protection program?

MS. SELMAN: No, we have never came close to stage one.

MEMBER STETKAR: One question, since we keep bugging you.

Has the flood protection program been in effect for Unit 1, for the entire life of Unit 1?

MS. SELMAN: Yes, it has.

MEMBER STETKAR: It has?

MS. SELMAN: Yes.

MEMBER STETKAR: Okay, thank you.

CHAIR RAY: So, it's been, as you called it, a wet site from --

MS. SELMAN: From day one, yes.

CHAIR RAY: All right, anything more than, other than the piece that remains to be gone through, and you said it would take?

MR. ARENT: Maybe 20 minutes.

CHAIR RAY: Twenty minutes, okay. We're about, therefore, I would say, we're going to be maybe -- by the time we take a break, which we'll do, we'll be maybe 45 minutes behind schedule.

But I suspect we may be able to get to make it up. If we don't before noon, then we'll simply add it to -- I'll decide whether to add it right after lunch or add it later. I say this for the benefit of those who may be stuck here.

But we'll go ahead now and take a 15 minute break, which is called for in the schedule, and we'll resume at MEMBER RYAN: 40 a.m.

(Whereupon, the above-entitled matter went off the record at approximately 10:20 a.m. and resumed at approximately 10:40 a.m.)

CHAIR RAY: We will resume the meeting, and Gordon, we're ready for you.

MR. ARENT: Okay.

CHAIR RAY: Okay to proceed.

MR. ARENT: Again, I'm Gordon Arent. Steve Hilmes is going to talk about the WINCISE special topic, and I'm going to go ahead and let him just get started.

CHAIR RAY: All right.

MR. HILMES: Okay, one of the larger changes we did in the plant was installation of the WINCISE system.

WINCISE is a non-safety related fixed core instrumentation system, used for mapping neutron flux in the core.

It does -- the probes themselves, which we call the in-core instrument thimble assemblies, IITA's, also contain the core exit thermal couples.

The core exit thermal couples are a post-accident monitoring system, and under -- under 603, it will be considered safety related.

MEMBER BROWN: Under 603, it would be

considered what? I didn't hear.

CHAIR RAY: Safety related.

MR. HILMES: Safety related.

MEMBER BROWN: You just said it was a non-safety related.

MR. HILMES: The flux mapping portion of the system is non-safety related.

MEMBER BROWN: That is the computer processing and all of that stuff?

MR. HILMES: Right, and the actual probes, neutron sensing probes inside the core.

MEMBER BROWN: Okay, but the -- which part is safety-related?

MR. HILMES: The core exit thermal couple.

MEMBER BROWN: Oh, that part of the --

MR. HILMES: Right.

MEMBER BROWN: Okay.

MR. HILMES: It's also contained in that probe, though. So, we'll discuss that a little later.

MEMBER BROWN: Okay, thank you.

MR. HILMES: Okay, historically, Gordon, if you could go to the next slide?

Watts Bar Unit 1 and originally, Unit 2, had a -- I'm not sure how to -- had a moveable in-core detector system. They had six probes. It was -- if you look at the drawing to your left, it had six probes that were in a mechanical arrangement, using Gleason wheels.

Each of the probes had to go through a five position indexer and a 10 position indexer. At the seal table, it would insert the probe into the reactor vessel, and in your chosen position, retract it and measure the neutron flux map, as it came back out.

This was done periodically. It wasn't a continuous monitoring system.

In addition, the core exit thermal couples originally came through the upper head, at -- we had 65 type A thermal couples, and there was a reference junction box that was in site containment.

Pretty much, WINCISE modification has eliminated all this hardware, except for the wet tubes going from the seal table to the reactor vessel, and replaced it.

Okay, so, Watts Bar Unit 2 has fixed in-core instrumentation. Therefore, we have continuous monitoring of the flux in the core, as far as mapping goes.

We've eliminated, as I said, all of the mechanisms associated with the mechanical system and it's pretty much all automated data collection that goes to our core-analysis software, BEACON, specifically.

The IITA assemblies are the probes internally. There are 58 in-core probes now. They go through the old wet tubes used for the mechanical system. Each of these probes have five vanadium self-powered detectors, and one type core exit thermal couple.

These are distributed in 2X, 29 in Rack A and 29 in Rack Bravo -- I'm sorry, 29 in Rack Alpha and 29 in Rack Bravo.

They're arranged in this manner, so that you can use an entire rack and continue to operate. You do need both racks, however, to start up, for the initial flux map.

Essentially, we have -- Gordon, why don't you go to the following sketch?

We have two-signal processing cabinets. Those are inside the instrument room in containment, and this is only showing one probe and the panel is only showing one of the racks. There is, as I said before, two of them.

So, what occurs is essentially, we do an A to D conversion directly inside containment at that

SPS panel, and it is sent out to the BEACON system.

The sets themselves, the reference junction box, which used to be in containment, is now in the actual Common Q panels. So, we've eliminated that piece in site containment, and all the set columns, the old columns that we had going through the upper head, have all been capped off, and so, that eliminates quite a bit of the radiation exposure in doing work around the head for the -- for working on those.

MEMBER STETKAR: Steve, I see, since the core exit thermal couples are safety related, those SPS cabinets in containment are all qualified?

MR. HILMES: No, I'm going to explain that now.

MEMBER STETKAR: Never mind, I'm sorry.

MR. HILMES: Looking at this drawing here, this little sketch -- and I don't know why this isn't working.

If you see at the top of the seal table, the sets split off at the seal table, where it -- if you look at seal table right above it, it breaks the --

MEMBER STETKAR: I guess Gordon --

MR. HILMES: Yes, it's not functioning.

MEMBER STETKAR: It's the mouse?

MR. HILMES: That's okay. So, it splits off in two. So, your individual thermo-couples run over to penetration directly --

MEMBER STETKAR: Oh, okay.

MR. HILMES: -- and get sent out to your Common Q panels.

MEMBER STETKAR: Okay.

MR. HILMES: Whereas, the vanadium detector signals, they go to the A to D panel --

MEMBER STETKAR: Okay.

MR. HILMES: -- the SPS panel, are converted into a fiber optic signal out to the BEACON system.

So, let's go to the next page, and let me explain how they deal with the isolation here.

If you -- this is much shorter version of the probe, but what they do is, the core exit thermal couple, which sits at the top of the probe, is in its own stainless steel sheath. It's mineral-insulated cable and it's separately sheathed to ensure that we have isolation between the non-safety related piece in the probe and the safety related probe.

The vanadium detectors are in there, in another sheath, together, and we -- they've actually done -- they do testing here, where they've shown that a 600-volt potential across them will not cause interaction between them and we have proven that that is the max -- the actual voltage is much less than that, that's possible to be seen.

MEMBER BROWN: The core exit thermal couples, this probe still runs from the bottom, up?

MR. HILMES: It comes in the bottom of the vessel and it just sits in your --

MEMBER BROWN: From the -- the thermal couple is at the top?

MR. HILMES: At the very top.

MEMBER BROWN: And then the other detectors are distributed, in some manner, down the length?

MR. HILMES: Yes.

MEMBER BROWN: So, you don't have to move this thing?

MR. HILMES: You don't move it, and the vanadium detectors, they're -- it's an interesting design, in that they -- they're kind of progressively longer.

So, if you look at the sketch, the number one detector is actually the full length of the probe, and then the --

MEMBER BROWN: That's the full length detector?

MR. HILMES: Yes.

MEMBER BROWN: This is just for --

MR. HILMES: The detector is the full length, and then the --

MEMBER BROWN: It senses flux over its full length?

MR. HILMES: That is correct, and then number two detector is, you know, part -- progressively smaller and it keeps working its way down, and the way that it deals with this is, it actually subtracts the probes, the flux from the one probe from the other one, in order so that you get the -- that particular area.

MEMBER BROWN: Yes, okay.

MEMBER SKILLMAN: If I could ask, back on page 36, please.

So, I think what you're communicating is that you have a 58 independent in-core detectors and each of these 58 goes through a separate fuel assembly?

MR. HILMES: That is correct.

MEMBER SKILLMAN: Understand, thank you.

MR. HILMES: Okay.

MEMBER STETKAR: Steve, if -- the seal table is still your --

MR. HILMES: That is correct.

MEMBER STETKAR: Right? You haven't sealed off --

MR. HILMES: No.

MEMBER STETKAR: -- at the bottom vessel head?

MR. HILMES: Actually, no, we have not, but the connector, the electrical connector is right at the seal table now, okay.

MEMBER STETKAR: Yes.

MR. HILMES: So, you don't really have an issue with it rupturing the probe and leaking out, because you have that seal up there.

MEMBER STETKAR: Okay.

MR. HILMES: It's pretty much what I have, just to summarize the advantages of us going to WINCISE, is that we have continuous monitoring now.

We've eliminated the penetration on the upper head of the sets, and by eliminating all of the complexity that we had with the old Gleason wheel system, we've gotten much higher reliability and a much simpler system.

MEMBER SKILLMAN: Another question,

please. On the thermal couple, what is the temperature range, for this device?

MR. HILMES: I am going to turn that over to Mike.

MR. HEIBEL: Mike Heibel, Westinghouse. The calibrated range of thermal couple is zero to 2300 degrees Fahrenheit.

MEMBER SKILLMAN: Thank you. What do you know about the thermal couples behavior above that temperature, please?

MEMBER STETKAR: Can you repeat that? We're having problems picking you up.

MR. HEIBEL: The range is zero to 2300 degrees Fahrenheit.

MEMBER STETKAR: Hold on a second.

(OTR comments)

MR. HEIBEL: The calibrator range of the thermal couples themselves is zero to 2300 degrees Fahrenheit, and that range is dictated by the post requirements Reg Guide 197.

So, all of the instruments in use are suppose to be operable in that range.

MEMBER SKILLMAN: What do you know of the behavior of the thermal couple above that temperature?

MR. HEIBEL: That is the limit of the

calibration curve that's developed for the thermal couple. So, actually, if you go beyond that, you're interpreting -- or extracting beyond the calibrated range, and I'm not really sure what that can do to the accuracy of the instrument.

Up to that range, we get into -- it needs to meet a 50 degree tolerance value.

MEMBER SKILLMAN: Okay, by any chance, do the vanadium detectors have a behavior of temperature that could be used in an accident?

MR. HEIBEL: Could they? They would certainly register. The problem is that so much with the vanadium is with the insulation, as you increase temperature, the insulation resistence would change.

So, the current for the same flux would be different. If we understood the relationship between insulation resistence and temperature, we could certainly arrive at a way to compensate for that, but that hasn't been done yet.

MEMBER SKILLMAN: The rhodium detectors at TMI went into thermionic emission, and that was the only temperature we had at the tail end of the accident.

MR. HEIBEL: Yes, actually I had --

CHAIR RAY: Dick, I can't hear you.

You're fine. You need to stand up.

MEMBER SKILLMAN: The rhodium detectors at TMI went into thermionic emission and that's how we learned, what we had in temperature at TMI 2.

MR. HEIBEL: While I say I hope I never have to know --

MEMBER SKILLMAN: I agree.

MR. HEIBEL: -- the mechanism involved in rhodium detector responses would be present there.

MEMBER SKILLMAN: Thank you.

MR. ARENT: Okay, are there any other questions?

CHAIR RAY: I don't have any. All right, we will now turn it over to -- like I say, we're about -- for the last hour, late, about 45 minutes or so. But we'll see how we do now.

MEMBER BROWN: I do have one question.

MR. HILMES: Yes.

MEMBER BROWN: Is Watts Bar Unit -- they still have the old system?

MR. HILMES: Yes, they still have the old system. Currently, I don't --

MEMBER BROWN: All right, it was just yes or no.

MR. HILMES: Yes, it's the old system.

MR. MILANO: Okay, go to slide number four.

CHAIR RAY: All right, I'm going to ask everybody to speak up, more than you normally would, just because -- until we can get it stopped, which is not a certainty, we're going to need to carry on.

MEMBER STETKAR: You, too, Harold.

(OTR comments)

COURT REPORTER: I'm just not sure if this is going to deal with the audio.

CHAIR RAY: You think it won't -- just speaking up isn't --

COURT REPORTER: Just listening to you, I can't make out about half of what's said.

CHAIR RAY: Okay, all right. We've got to do something about it, would you?

MR. MILANO: Staff is doing something about it.

CHAIR RAY: All right.

(OTR comments)

MR. MILANO: Okay, again, my name is Pat Milano.

On the basis of the work -- the final remaining designs have Watts Bar Unit 2, and in response to requests for -- or to clarify the information in the FSAR, TVA has continued to amend the FSAR and as of today, the FSAR is at Amendment Number 106.

As you can see from the contents of the last four supplements that --

MEMBER BROWN: Can I ask you a question?

MR. MILANO: Yes.

MEMBER BROWN: I've only gotten up to 104, and I've got one section of 105, which was the Chapter 7 part. Is there any plan to give us the other stuff at some point, or have you seen any of it?

MR. SHUKLA: No, I have not seen it.

MR. MILANO: We haven't -- we have been providing it --

MEMBER BROWN: I know you've been providing it. I'm not -- this is not a criticism. It's just that there seems to be this -- I mean, you have to check between the FSAR's, as well as your SER's, to see what they even apply to, because the -- they don't always include -- they're not at all conclusive in every case.

MR. SHUKLA: Yes, I only got 104 when I requested it yesterday.

MEMBER BROWN: Yes.

MR. MILANO: Not to get into a dialogue,

but we've been providing these. We've been providing them, you know, hard copies -- or excuse me, diskettes, and we've been sending them over with a memo, transmittal memo.

What we will do is, we will work with Mr. Girija, to make sure he's got everything that has come in.

MEMBER BROWN: Okay. Sorry, John, you look like you were going to say something.

MEMBER STETKAR: No, that's -- all of 106 is in, not just sections?

MR. MILANO: That's correct. Each one of the amendments --

MEMBER STETKAR: Comes in as a --

MR. MILANO: -- as a complete item, that's correct.

MEMBER STETKAR: With just the changed parts, yes.

MR. MILANO: That's right.

MEMBER STETKAR: It would be really useful, to have one of those.

MR. POOLE: This is Justin Poole, one of the other PM's.

I believe that all of the SE's that were submitted and written, for SER-24, at the time, we only had Amendment 104 in house.

MR. MILANO: That is correct.

MEMBER STETKAR: Yes, but I mean, I even ran into it, because if you refer to 104, and until today, I didn't have 104. So, you never know what you don't know, is the problem.

MR. MILANO: All right, again, as you can see from the contents of the last four SER's supplements, that the staff has published, a significant portion of the Watts Bar Unit 2 FSAR has been reviewed, along with TVA's response to generic communications, various corrective action programs and major programs, under -- required under --

MEMBER BROWN: Oh, I do have one other question.

MR. MILANO: Yes, sir.

MEMBER BROWN: Relative to the just the admin part. I've got SER-24. I went back and I noticed that you all -- every one of the SER's that you sent in, are they -- are they complete like the FSAR pieces are? They're not?

MR. MILANO: No, they are not.

MEMBER BROWN: They are not? So, you've got to search between --

MR. MILANO: That's correct.

MEMBER BROWN: I just wanted to make sure I had the calibration.

MR. MILANO: And that is why we initially started out with a road map in Supplement 21, so that you could see what all the changes were, on the various sections, and what supplement affected that section, and as we -- and we will continue in Section one of each one of the SER's -- SER supplements, that we update it.

So, let's say --

MEMBER BROWN: Okay, thank you.

MR. MILANO: Right.

MEMBER BROWN: I did not realize that.

MR. MILANO: I know, it is --

MEMBER BROWN: I've been searching and trying to destroy stuff, as I go through. So, all right, that's enough.

MR. MILANO: All right, okay.

MEMBER BROWN: I can understand the system here.

MR. MILANO: So, again, we've -- you know, we've reviewed major programs required under 10 CFR 50.34 and also, we're starting to review the proposed technical specifications and most of these areas, as you see up here, through Supplement 23, were presented up through the last presentation.

For the major areas remaining to review, and we discussed this before, the fire-protection report is going to be -- is the major work activity that is currently under way. The staff, although it wasn't in Chapter -- it wasn't in Supplement 24, the accident dose consequences is being finalized and will be published in Supplement 25, which we're going to talk about in December.

And again, as we've discussed with Mr. Ray, closure of open items for the SER review is under way, and will be -- in the subsequent supplements, you'll be seeing more of the open items being addressed and lastly, we're completing the -- we're in the final throes of completing the draft supplement to the final environment statement, which we are -- our goal is to issue that draft for public comment by the end of the month, it looks like.

CHAIR RAY: Well, wait a minute. Let me just take one up there, Chapter 16.

MR. MILANO: Yes.

CHAIR RAY: All right, a lot of material here in Supplement 24 on Chapter 15.

MR. MILANO: All right.

CHAIR RAY: Goes to -- what the heck is

it? It's 66 pages.

Now, what is -- tell me what -- how we're suppose to think about that. Is something -- is that something we reviewed four or five months, a year ago, or what?

MR. MILANO: Chapter 15?

CHAIR RAY: Yes.

MR. MILANO: No, Chapter 15, we have not talked about accident transient analysis --

CHAIR RAY: Okay.

MR. MILANO: -- at all, beforehand.

CHAIR RAY: Well, when I look at these, the major reviews areas remaining, I guess you're talking about major review areas for yourself.

MR. MILANO: That is correct.

CHAIR RAY: All right, and I guess our interest is more in when, because I have to coordinate this with the other members of the committee, make sure they're here, make sure they've gotten the word, this -- that Chapter 15 is coming up at this time or that time.

So, what I would like, Patrick, is your roadmap for us, not for you.

MR. MILANO: Okay.

CHAIR RAY: When should we expect to

review what?

MR. MILANO: Okay.

CHAIR RAY: I'm not real interested in when you're going to review it.

MR. MILANO: Go to slide 26. Jumping to the end of our presentation, just to show you what I was planning to do.

This is kind of a ramp up of a slide for -- that we're planning to go to, and just for the ACRS Subcommittee meetings, we're looking at the December meeting, we're going to talk about both operational and accident dose considerations, as covered in Chapters 11, 12 and 15.4.

CHAIR RAY: Right.

MR. MILANO: And then April, we were -- April Subcommittee was going to -- we were going to talk about fire protection.

CHAIR RAY: And what about the rest of Chapter 15?

MR. MILANO: That is what we're talking about today.

The accident and transient analysis, from the reactor side, is going to be discussed today. From the consequence side, that is going to be in December.

CHAIR RAY: All right, I understand.

MR. MILANO: Yes, okay. Okay, go to slide 5. Okay, and quickly, Supplement 20 -- since we're going to be discussing things in both Supplements 23 and 24, just 23 was published in July, and 24 was published last month, in September.

Okay, next slide. You've heard most of this, this discussion about hydraulic engineering in detail this morning with -- from TVA.

However, I'll just try to synopsize a little bit, as to what the staff has done in the -- and the overall findings of the staff, and I've got -- I've got members of the staff here, Mr. Dan Hoang, and on the side, Mr. Kamal Manoly, in case you have specific questions.

The staff found that the major changes -- that TVA made major changes to the hydraulic engineering evaluation based on the latest information from the Corp of Engineers and National Weather Service and the Geological Survey.

TVA stated that the PMF elevation is 738.8 feet and that in enveloped the calculated potential dam failure analyses.

TVA further stated that it had not changed the breach sizes and as a result, the PMF elevation is

738, which exceeds the original PMF elevation, but ensures that margin still exists to protect critical equipment.

The Unit 2 PMF analysis and the seismic dam failure analyses credited increased height of embankments at the four dams, Fort Loudoun, Tellico, Cherokee and Watts Bar.

The increased height prevents overtopping and failure of these embankments during a PMF event.

In this regard, the reservoir head-waters will not have reached the bottom elevation of these sand baskets. Therefore, a hydro-dynamic loading condition, as a result of a seismic event does not apply in this situation.

MEMBER STETKAR: Pat?

MR. MILANO: Yes.

MEMBER STETKAR: You mentioned that the 738.8 elevation, the conclusion is that necessary equipment, at least to establish the flood mode operation, is still protected --

MR. MILANO: Yes.

MEMBER STETKAR: -- at that elevation. When I asked the question about the reduced number of spillway gates at Chickamauga Dam, TVA indicated that the PMF flood level that they were currently evaluating, but not published, would be greater than 738.8.

A couple of different numbers were mentioned, but anyway, it would be higher than 738.8.

Is there still assurance that that equipment will be protected at that level, and since they haven't done the seismic analysis, with the reduced number of gates at Chickamauga, do we have any confidence that the seismic flood levels, granted, there is extra margin in the flood, there's about seven feet margin.

So, I wouldn't expect the flood level to become dominant, but --

MR. MILANO: I'll make a stab at answering that.

MEMBER STETKAR: But PMF, at least, do you still have confidence that that margin exists?

MR. MILANO: I'm going to make a quick stab at answering your question, then I'll turn it over to one of our reviewers, if they have more.

The fact is, is the reduced spillways at Chickamauga are not currently in operation, and are not planned to be for several years.

So, for licensing of Watts Bar Unit 2, they weren't -- the staff did not evaluate those --

the reduced spillways, and so, it's -- to answer your question, they answer is no, we have not reviewed it, and in the -- and the reason being is, is it's not something that's been presented to us.

MEMBER STETKAR: When in the -- I'm woefully inept at understanding regulatory processes.

In the future, when they implement that change, are they required under the license, to resubmit the flooding analysis?

MR. MILANO: They will have to -- what they'll have to do is, they'll evaluate these proposed changes under their 10 CFR 50.59 program, and assume -- and just not saying positively, but I would assume at this time here, since the design basis in the FSAR is being changed, and it would screen into having to have a review, and would most likely have to come in for prior staff approval, before they actually implement it.

MEMBER STETKAR: So, it would get triggered under the --

MR. MILANO: That is correct.

MEMBER STETKAR: Okay, thanks.

MR. MILANO: Okay, continuing on. Because the -- the predicted PMF level is dependent on these temporary modifications that are currently in place, which are the sand baskets, which you heard about, which add approximately four feet in height in the vicinity of the four dams, TVA has agreed to confirm the stability analysis of the sand baskets used in Watts Bar Unit 2 licensing basis, by performing either a hydrology analysis without crediting the use of the sand baskets at the Fort Loudoun Dam, for the seismic dam failure, and flood combination, or by performing a seismic test of the sand baskets.

Next page, and thus, this is one of the open items that the staff needs to confirm. Yes?

MEMBER BROWN: If I could back-track a little bit.

The statements over here, the increased height prevents overtopping and I presume that means we don't flood the plants.

MR. MILANO: No, it means that we're not going to -- it's not going to go over the top of the dams, such that you would get --

MEMBER BROWN: Okay.

MR. MILANO: -- dam erosion.

MEMBER BROWN: All right, well, let me back-track even farther then.

Under the probable maximum flood level, how much margin is that, to when -- if it exceeds your

PMF, how much margin is there to where the plant has a problem? Is it a foot? Is it 10 feet?

MR. MILANO: There is -- I mean, for the ERCW system, and I'll let -- TVA can confirm it here, it's 741 for the high pressure fire pumps, and ERCW, it's -- and it's about -- there is about, I believe it's a foot and a half margin to the diesel generators, diesel generator building, and I'll ask TVA to reconfirm.

MEMBER BROWN: And that's your 25 year flood, based on the first view-graph, one of the early view-graphs that shows that, is that correct?

The PMF is based on the 25 year -- well, I thought that is what it said, up in the front.

MR. MILANO: Can you answer that?

MEMBER BROWN: If you could figure out how to figure that out, you're better than I am.

CHAIR RAY: I think you're referring to the size of the flood that's combined with the OBE and the SE.

MR. MILANO: The SE, yes.

MEMBER STETKAR: There is sort of three flood things, Charlie.

One is a PMF flood, and that is a construct from rainfall and Corp of Engineers hydrologists and --

MEMBER BROWN: Yes, but based on how long a period of time?

MEMBER STETKAR: It's actually constructed from -- and TVA can answer this. It's actually constructed from two storms, two three-day period storms.

MR. MILANO: That's correct, separated by a week.

MEMBER STETKAR: By the -- I think it was --

MEMBER BROWN: Okay, so, it's not a historical --

MEMBER STETKAR: And you know, the rainfall amounts that happen during those storms, and the timing of the rainfall and the flows, it's a rather complicated -- but it's a construct.

For their seismic analyses, they're required by regulatory -- well, under regulatory guidance, not required, but they use an operating basis earthquake in conjunction with half the water volume from that PMF. Well, I don't know if it's just -- or they use a safe shutdown, and they must use also a safe shutdown earthquake, higher acceleration, but with only a 25 year flood.

MEMBER BROWN: Okay.

MEMBER STETKAR: So, it's the notion of -- it's some sort of notion of ad hoc convolution of storms with seismic --

MEMBER BROWN: I was just trying to get --

MEMBER STETKAR: -- in a very discreet manner.

MEMBER BROWN: This is very visceral. I just remember, you know, the Fort Calhoun circumstances, that we had during the recent floods in the Midwest, and watching the water, you know, in some places, it was -- it looked like -- looking at it on TV, inches, that's what it looked like. It might have been a little bit more.

Were those -- has anybody ever looked at what happened there, and compared it to their analysis, to see, you know, were they close or not, and how did it apply to any of our future thought processes?

MR. MILANO: It was not part of the Watts Bar Unit 2 review. We did not go back and relook at what took place at Fort Calhoun.

MEMBER BROWN: Okay, I am just thinking about this from the Fukushima and other type standpoints, that -- how do we evaluate our fundamental, you know, large environmental concerns, whether it's flooding or earthquakes and/or tornados or hurricanes, etcetera.

MR. MILANO: Okay, understand.

MEMBER BROWN: Thank you.

MR. MILANO: Okay, as noted earlier, TVA re-verified the design basis flood levels of Watts Bar Unit 1 and 2, and as a result, the PMF elevation, again, increased.

Remember, it's -- I say 734.9 to 738.9, because, you know, there was that dip and then rise again.

TVA indicated that the hydrological analysis performed in support of Unit 2 design-basis flood elevation resolved the deficiencies identified in the re-verification process.

The FSAR also -- was updated to show the increased height credited at the four dams, as part of the current licensing basis for Unit 2.

Further, TVA stated that Fort Loudoun, Tellico, Watts Bar have been previously judged, not to fail for the OBE, that the operating basis earthquake at .09G and the postulation of the Tellico failure in the combination has not been evaluated, but is bounded by the safe shutdown earthquake failure at the other three dams.

On the basis of TVA's statement regarding multiple failures and dam failure permutations, the staff has created an open issue pending TVA providing technical justification to support that Fort Loudoun, Tellico and Watts Bar have been previously judged not to fail for an OBE.

Postulation of the Tellico failure in this combination, you know, as I indicated, wasn't -- I was repeating, again, what I had previously said, was previously bounded by the other three dam SSE failures.

TVA indicated that Cherokee and the Douglas Dams require rigorous evaluation in the form of a finite element analysis to confirm their structural adequacy and functionality for long-term operation.

The staff agreed with TVA's actions as confirmation of its earlier operability determination for PMF related to the other operating units, Sequoyah, Browns Ferry.

TVA also indicated that the estimated completion of such analysis will likely extend beyond the projected start of operation for Unit 2.

Therefore, the staff requested that TVA

discuss how the licensing basis of Unit 2 reflects the short-term operability and long-term functionality of these dams, and in this regard, the staff has proposed two license conditions, as you heard from TVA this morning, which I'll repeat here.

You know, by August 31, 2012, TVA will submit for staff review and approval, a summary of the results of the finite element analysis, which should demonstrate that Cherokee and Douglas Dams are fully stable under design basis probable maximum flood loading conditions, for long-term stability analysis, including how -- the pre-established acceptance criteria were met.

Second, TVA will submit, before completion of its first operating cycle, its long-term modification plan to raise the height of the embankments associated with Cherokee, Loudoun, Tellico and Watts Bar Dams.

The submittal shall include analyses to demonstrate that, when the modifications are complete. The embankments will meet the accept -- the applicable structural loading conditions, stability requirements and functional considerations to ensure the design basis PMF limits are not exceeded at the Watts Bar Nuclear Plant.

All modifications to raise the height of the embankments shall be completed within three years from the date of issuance of an operating license.

CHAIR RAY: Okay, I do not see anywhere, that we can write a letter on this, to just say it clearly.

It's just not a consistent, clear -- it's just a whole welter of specific piece parts, that don't add up to anything consistent.

So, I don't know what you're going to do about that, but that's -- I think the sense we have, if you just take what you just said, Patrick, and listen to it, it's just a bunch of specific things, they're going to do this, going to do that, going to do the other thing.

But they don't add up to anything that makes -- I don't want to say that makes sense, but that has a consistent basis. It's just a whole hodge-podge of specific actions.

I don't know how we can -- I don't know how you came to the conclusion that it's okay, but in any event, I'm not sure how we can.

So, that's --

MR. MILANO: All I can say is, you know, the staff came to its conclusion, and --

CHAIR RAY: But it doesn't -- the staff isn't explaining to us how you came to the conclusion.

You have these two license conditions that you just ran through here. We've got them on page 2-6. We've all looked at them. Why is that okay?

MEMBER STETKAR: Let me ask a specific question, and it kind of follows up what Harold has just said.

One of the conditions that you mentioned was TVA should provide justification that Fort Loudoun -- the -- justification for the statement that Fort Loudoun, Tellico and Watts Bar previously judged not to fail at the OBE.

Well, Chickamauga is also previously judged not to fail at the OBE. Are you confident with their assessment of Chickamauga, or are you just not concerned about Chickamauga because it doesn't happen to be upstream from the site, and you're worried about too much water, rather than not enough water?

MR. MILANO: The analysis we did here was -- you're correct, for too much water. It's not -- it's not the staff -- I know the staff has looked at the loss of Chickamauga and the water level -- you know, there being sufficient water level to maintain the alternate heat sink.

I can tell you, I know that for a fact, because I'm remember the staff -- having been involved with some of the staff discussions, where TVA talked about the fact that there is a natural weir in the river and stuff like that, which tends to mitigate some of the effects of loss of that downstream dam.

So, it's -- no, it was not -- the Chickamauga Dam was not ignored and stuff --

MEMBER STETKAR: But it's discussed in Section 2.4 of the FSAR. There are a couple of different places that talk about inadequate flow and consequences from catastrophic failure at Chickamauga, under assumptions that you can open the gates and get water flowing into the river at Watts Bar.

Now, if the seismic analyses were to show that for example, the gates at Watts Bar could not be operated, and Chickamauga Dam could actually fail, it strikes me that that could be a concern for safe operation of the plant, because you would not have adequate ERCW.

So, I'm curious, you know, for example, were those types of questions asked, because I -- as Harold mentioned, in these sort of six pages of few things, there doesn't seem to be evidence of that.

CHAIR RAY: Yes, it's not clear, how the

staff comes to its conclusion.

It's clear that there are many things, some of which get done down the road. Why that is okay? I couldn't find anything that said, this is okay because. It just said what they're going to do, period.

So, we're left to our own, to try and figure out why it's okay. Must be okay, because there is -- you've accepted the license conditions, but why, I can't -- I can't explain. I can't --

MR. MILANO: Well, you know, the thing is, is that this is not -- this is not just an issue that because Unit 2 is coming online.

I mean, this is a site issue. It already applies to Watts Bar Unit 1, and the --

CHAIR RAY: Well, fine, then why not handle it just like seismic? Don't even talk about it here, and say, this all has to do with Unit 1, and Unit 2 will follow in its wake.

But the problem is, we're having to sit here and try and judge independently, by law, whether or not all of this makes some kind of sense, and I can't find a pathway through it.

MR. MANOLY: Can I add something? My name is Kamal Malony, Division of Engineereing.

The premise of the whole issue about license conditions is that we asked, what situation exists in Unit 1, where you're operating under the determination, that is also applicable to Unit 2?

So, any issue that is not meeting complete compliance with the licensing basis for Unit 1, we wanted that formalized in Unit 2 license condition, and that was the premise behind this whole thing.

CHAIR RAY: Well, it may be, but you know, again, I keep drawing the analogy between seismic and this.

You don't explain why it's okay. I mean, I think you just attempted to there, and I do understand the idea of an existing plant and other plant being built. I've been through that myself. I understand how it works.

But the point is, we're sitting here looking at Unit 2 right now, and trying to figure out why is this okay? Do we advise the Commission that we think this is okay?

All right, how the heck do I -- I don't see you explaining to us, why it's okay, and therefore, it's hard for us to come up with our own explanation, and you know, I'm trying to think about the fact that well, maybe, we're really talking about

Unit 1, here.

MR. MANOLY: Yes.

CHAIR RAY: We're not talking about Unit 2, at all?

MR. MANOLY: Right, if you accept the premise that you can operate under the determination for certain amount of time for Unit 1, it's a typical operating unit. It's should also follow the logic that should apply to Unit 2, which is not operating unit, yet.

CHAIR RAY: Well, why don't you write that down, then? Just what you just said, and I think the answer is, because it will never fly.

MR. RAGHAVAN: This is Raghavan. I think what we need to do is go back and present to the ACRS, next time we come, the hydrology in the most concise manner, and I recommend that we address three things.

CHAIR RAY: All right, that's fine.

MR. RAGHAVAN: Number one, we still understand the design that was promised, that there be issues that we have. We define the probable maximum flood scenario under which the PMF is established.

Number two, we will discuss the mitigating functions, if the flood level is higher, and number three, we'll also talk about what Mr. John Stetkar was talking about, a downstream effect of not looking at the nuclear plant, but also, from the emergency preparedness.

I suggest that we postpone this discussion for the next meeting.

CHAIR RAY: I think that's the right answer. I just want to give you enough feedback that we don't keep iterating on this over and over again.

MR. RAGHAVAN: We will do so.

CHAIR RAY: Yes, and speaking of things that we're going to defer, we're going to defer the discussion of Chapter 15, because looking at the clock, and looking at the fact that we didn't have time really, to prepare for that discussion, we're going to have to do it later, too, the whole thing.

MR. MILANO: Okay, so, we'll discuss both the accident and the consequences in December?

CHAIR RAY: I expect so, yes.

MR. MILANO: Okay.

CHAIR RAY: But that's an aside. Here, I am just trying to give you enough feedback, so the next time when we get together, we can say, okay, now, I understand how the staff came to the conclusion that it's okay to issue the license for operating Unit 2, under the following 14 different assumptions and conditions. It now makes sense to me.

I'm sure that we can do that, but right now, it just doesn't work, is what I'm telling you, and you can read these license conditions, for example, you can say, "Well, it looks like that's a good idea," but you know, why is it okay for it to take as long as it is?

My assumption is that it has something to do with the fact that these are really requirements that need to be satisfied, that pertain to an operating unit, specifically to Unit 1, and perhaps to other plants, aside from Watts Bar, and that on that basis, the staff concludes that it's okay to have Unit 2 go into operation on the same basis that the other units are in operation, namely that these things are going to be, like you just read, are going to be addressed for all the units, over time.

There are some other things, though, that, you know, for example, I mentioned the issue of reactor coolant pump seals.

It turned out, we're looking at changing the pump seals, so they're more robust under the kinds of conditions that we might encounter here with the flooding.

Okay, that's fine, but is that just a

matter of adding the margin and it's okay, now, the way it is? I guess so, but I'd like to hear that discussed.

Anyway, I go on too much. I'll stop now.

MR. RAGHAVAN: We will include that agenda, in not in December meeting, then include it in the April meeting.

CHAIR RAY: All right.

MR. RAGHAVAN: So, we'll get back to you on that.

CHAIR RAY: Okay, thank you. I appreciate your responsiveness and you know, we're not trying to create more possible hurdles here, but we have spent time trying to get our arms around this, and I've got to give you feedback that says we need to take another shot at it, so, we'll just do that.

MR. MILANO: Okay.

CHAIR RAY: All right. Okay, I probably interrupted you, so, please.

MR. MILANO: No, that's fine. Now, I'm going to turn it over to Mr. Mathew Panicker, from our fuels organization, the fuel for performance organization, and he'll discuss Chapter 4.

CHAIR RAY: Thank you.

MR. PANICKER: My name is Mathew Panicker.

CHAIR RAY: I'm going to ask you to speak really loud, louder than you're comfortable speaking, probably.

MEMBER RYAN: Try not to whack the microphone, because it's very loud, and we can't hear.

CHAIR RAY: We're having a hard time creating a record today. So, go ahead.

MR. PANICKER: Name is Mathew Panicker with one T and one N in my name.

I belong to the Nuclear Performance and Code Review Branch, which primarily deals with fuels.

This is -- the fuel design for Watts Bar Unit 2, I am going to talk a little bit, the fuel design for Watts Bar Unit 2.

In 2003, Watts Bar Unit 1 switched the fuel design from Westinghouse to RFA-2, RFA stands for robust fuel assembly generation 2.

So, Watts Bar Unit 2 will consist of entirely new RFA-2 fuel, but unlike Watts Bar Unit 1, the core for Watts Bar Unit 2 will not have any tritium-producing rods.

Now, the -- what we'll rely on approving of fuel design, in the agency is, this fuel, when there is process, they have a generic mechanical design and nuclear design process, which Westinghouse calls it FCEP, fuel criteria evaluation process.

So, there is a generic document, document reports to the agency, and we go through it, approve it, with a lot of RAI's and so on, and then, for any change in the successive fuel designs, they have to submit it to us, and then we'll go through it again, whether they conform to the original process criteria.

So, that is how the fuel design is approved.

Here, the mechanical design features of the RFA-2 fuel in the load, integral burnable absorbers, Westinghouse integral nozzle and debris filter, bottom nozzle, external burn-up capability, axial blankets and ZIRLO, ZIRLO is Zircaloy with a different composition for it, for fuel and many structural components.

Based on the review, Watts Bar Unit fuel safety analysis, the satisfactory experience of the fuel type with other operating reactors and experienced approval of the fuel type in Unit 1, the staff is concluding that RFA-2 fuel for Watts Bar Unit 2 will perform its function adequately and that the materials as met operational regulatory requirements.

TVA has described converter programs and calculation techniques used to predict the nuclear characteristics of the reactor design and provided examples to demonstrate the ability of the analysis to predict the reactivity and physics characteristics of the Unit 2 core.

There are now changes to the reactor, there is a result of reactor heat-up. Changes in operating conditions, fuel burn-up and fission product build-up and significant amount of excess reactivity designed into the core.

Also, they have shown that sufficient control rod is available, as excess reactivity at all times. The sufficient control rod is available to make the reactor sub-critical, in the Watt condition, at any time during the cycle, with the most reactor control rod stuck in the fully withdrawn position.

So, in that respect, the staff has concluded that TVA's assessment of reactivity control determines how the first core cycle is suitably conservative and that the control system provides adequate negative, to ensure the shutdown capability.

Now, one issue with the mechanical design of the fuel is the inadequacy in the treatment of thermal conductivity, as a function of temperature and burn-up.

That one is still an open item, because as the fuel burns, as it irradiates and as it is irradiated in the core, the thermal conductivity of the fuel is deteriorating, particularly, the reasonably high burn-up with a range of 20 to 30 degrees for this turn.

It will -- the thermal conductivity is dependent on several physics and engineering changes in the fuel, such as sufficient gas release, porosity and all kinds of similar actions.

So, we -- if we treat the thermal conductivity in the fuel in a conventional manner, we don't get the correct thermal conductivity to be put into the safety analysis.

So, the temperature and the total energy content in the fuel will be -- cannot be conservative enough to have the analysis, in the analysis.

So, we have put an open item, and we are expecting the analysis staff with additional information from TVA to demonstrate that path four, which is the performance analysis core for fuel performance, can conservatively calculate the fuel temperature and other impacted variables, such as the stored analogy, even the lack of fuel, thermal conductivity and radiation model. This is going to be remaining as an open item until we hear from TVA or the fuel vendor.

Now, as far as the thermal-hydraulic design of the fuel is concerned, the staff reviewed the thermal-hydraulic design, the scope of the review included design criteria, core design, steady-state analysis of the core thermal hydraulic performance.

The review concentrated on the difference between the proposed core design and those designs previously reviewed, and found acceptable by the analysis staff.

In this respect, there are two things which comes to the mind, is the thermal-hydraulic compatibility of the fuel is there. It is there because the core is filled with the same fuel, unlike some other cores, and also, the case of mixed core issues do not come because it is the same fuel.

So, all the fuel assemblies will have the same pressure drop from the flow, so, those issues will not come until they change the fuel or as it burns in the fuel.

So, thermal-hydraulic design of the core therefore, meets the requirements of GDC-10, General Design Criteria 10, and is acceptable preliminary design approval.

In the CR Section 4.4.9, the staff

document -- has documented that TVA has committed to three operational and initial start-up test programs in accordance with the Regulatory Guide 1.68., initial test programs for water-cooled nuclear power plants, to measure and confirm the thermal-hydraulic design aspects.

MR. MILANO: Pending any questions, that completes the specifics of the fuels for Chapter 4 and now, we'll continue on with the WINCISE in-core instrumentation system.

CHAIR RAY: Okay.

MR. PANICKER: The in-core instrumentation WINCISE system, which is called by Westinghouse, the in-core instrument -- Westinghouse in-core instrumentation surveillance and engineering system, the WINCISE, which is -- I think which is -- this is similar system is probably the second unit, which is in this country, which is, I think the -- Sea Brook has the same system.

This system is used to produce continuous core power distribution measurement using the BEACON TSM, TSM for technical specification monitoring, systems.

MEMBER STETKAR: Mat, before you get going, you mentioned this -- I don't know what plant this is, it may be the second installed in the U.S.

Do you know, has this system been installed in any plants internationally? Maybe TVA may know.

MR. PANICKER: Westinghouse might have done --

MR. MILANO: Westinghouse is there.

MR. HEIBEL: This is Mike Heibel, again. We have BEACON system working with fixed in-cores at the Temelin plants in the Czech Republic.

MEMBER STETKAR: Thank you.

MR. PANICKER: So, the Watts Bar Unit 2 WINCISE system uses 58 IITA's, which is the -- stands for in-core instrument thimble assemblies, each at five self-powered vanadium detectors SPND for self-powered neutron detector elements and one ground junction core exit thermal couple.

Each IITA is inserted into the instrumentation tube of the fuel assembly, through the bottom nozzle, IITA length. Within the fuel assembly is such that CET, core exit thermo-couple at the end of the elbow, at the end gauge, on top of the active fuel.

The vanadium SPND is a radiation sensing device that uses transport of high energy electronic released from the detector/emitter, so, you can use vanadium, rhodium or platinum, if the vanadium is used, which will have some distinctive effect on the rhodium. One is the life time.

The life time of vanadium detectors is around 20 years. Whereas, rhodium detectors are less life time.

The emitter currently will be -- when they are exposed to neutrons, the electrons are -- the neutrons are absorbed and the electrons are released from the detector emitter, when exposed to neutron and gamma radiation.

The emitter currently will be proportionate to the reactors, the neutron or gamma released in the incident on the material.

So, each WINCISE SPND is the material -- is of mineral insulated cable, consisting of a significant vanadium remittal section and an extension member.

The vanadium detector is -- as you saw the diagram from the TVA, they have second increasing in length. This arrangement enables the axial power distribution in the post fuel assembly to be absorbed into five segments.

The first four segments, being the

difference between the successive SPND. So, for the second one, the difference will be first and second and so on, second and so on.

The fifth being the current from only the fifth detector. So, the advantage of this is, the failure of one -- any single SPND element decreases the axial resolution of the core power.

But it does not render the remaining SPND elements in the element inoperable.

So, really, one is gone, the other system is not inoperable, particular for this, because of the added suppression.

Each OPARSSEL is -- is an acronym for -- it is some -- the system used by WINCISE is called optimized proportional axial region signal separation extended life, OPARSSEL, optimized proportional axial region signal separation extended life.

Each OPARSSEL houses a CET which is positioned to provide a measurement of each -- the reactor coolant and pressure at the top of the active fuel, of the lost fuel assembly, initial at the bottom of the OPARSSEL plate as they are installed in Watts Bar Unit 1.

The CET measurements are used by post-axial monitoring systems and are not used by the

WINCISE system, as before.

The SPND in this are both actually and regularly distributed, using the reactor core to provide continuing signals that are directly proportionate to the neutron flux in the immediate vicinity of the SPND's.

The measured SPND signals are processed by use of the BEACON-TSM power distribution monitoring system, PDMS.

They generate the continuous three-dimensional measurements of the reactor core power distribution. The SPND signals are routed through there fiber optic cables, to the BEACON-TSM calculation.

CHAIR RAY: Okay, we've read that, I think, but is there anything about the staff's evaluation that you want to share with us? We're running short on time.

MR. MILANO: Actually, no. We found that the -- that TVA -- or excuse me, TVA and Westinghouse really didn't change much with regard to the way the signals are processed into the flux, you know, into the measurement portion.

So, we found that aspects pretty much consistent with what was previously utilized. This new system -- the new -- the new instrument system was evaluated.

We do have -- we were going to have some further discussion, with regard to the instrument, instrument itself, and if you bear with us, we can just hit some highlights of what the staff looked at, as the WINCISE portion of the instrument itself, and --

CHAIR RAY: Well, that's fine, Patrick. You decide how you want to use this 15 minutes.

MR. MILANO: Okay.

CHAIR RAY: But at 12 o'clock we've got to stop.

MR. MILANO: Right, okay. Actually, this ends it, anyway, because after that, we were going to talk about axial transient analysis, and since that is deferred --

CHAIR RAY: I perceived that that would be the outcome, that's why I said what I did.

There was an item here on the agenda, and I just don't want to overlook it, but -- in which Region 2 would say anything that was --

MR. MILANO: That was the --

CHAIR RAY: -- appropriate to do.

MR. MILANO: That was there, just in case you had some questions.

No, they don't have anything specific, now.

CHAIR RAY: All right, now, we don't have any questions, to my knowledge.

MR. MILANO: Okay, Mr. Rahn.

MR. RAHN: Sure, my name is David Rahn. I'm the Senior I&C Engineer in the Office of NRR, and if we could just jump to slide number 12.

What we did is, because -- if you recall, Steve Hilmes described the fact that the cores of thermal couples, which are Class 1E, are in the same overall achieved as the self-powered detectors, and then the -- they split, and you can show it. See where that split is?

It becomes at that point, a split between a Class 1E component and a non-Class 1E component.

So, what we're required to do, as part of our analysis, is to ensure that there aren't any events or problems that would occur in the non-1E portion of the circuit, that could then propulgate toward the 1E portion and degrade it, in any way.

So, we combined our evaluation of the WINCISE portion, primarily with regard to looking into reliability, which if there is a lot of redundancy built into that system, so it is reliable.

But the important thing for us was how did they address the criteria for separation and isolation, and in that regard, we had evaluated some reports that Westinghouse put together for TVA.

Specifically, we have a Regulatory Guide 1.75, has to do with independence of Class 1E components, and independence on separation requirements, and the requirements are codified in -- or not codified, they're actually a standard for that IEEE-384.

And so, what we did is, we evaluated what does IEEE's 384 say, with regard to joining together a 1e and a non-1E component, and there are some specific directions provided in that standard, that say that if you cannot meet the minimum separation criteria, it's all right to perform an analysis and in this case, Westinghouse provided not only an analysis, but they supplemented with some test data.

But specifically, they were able to demonstrate for us that if there was a fault of a 4kV's power, that could impact any of the power supply cable going into the SFAS, the signal-processing cabinet, their analyses showed that the maximum surge capability that is probable at the output of the power supply inside that could only put a 248 volt surge on the lines.

And so, at that point, they were also able to show us that they performed testing of conductor to ground and conductor to conductor 600 volt surge tests on the middle insulated cable connections, and those tests demonstrated that there is not degradation in insulation resistence, and that was satisfactory for us, to meet the IEEE 384 requirement.

CHAIR RAY: Is that an environmentally or an aged conclusion? In other words, the way you just expressed it, it could be a test that really didn't apply under the conditions that we would --

MR. MILANO: Yes, in that particular case, the test that they performed was of new cable, of new mineral insulated cable.

CHAIR RAY: Right, so, why would that then suffice, if you were talking about something in service?

MR. RAHN: Well, the -- it was by far -- the energy that is coming from the signals itself, is on the order of five micro-amps.

So, the total number of aging that the cabling experiences over its life time is -- hardly impacting the ceramic insulation.

CHAIR RAY: All right, so, I mean, the point is that it doesn't neglect that potential. It's just, your judgment is --

MR. RAHN: Correct, our judgment is that it is hardly having an effect.

CHAIR RAY: Okay.

MEMBER STETKAR: Dave?

MR. RAHN: Yes.

MEMBER STETKAR: You mentioned -- you said ceramic insulation?

MR. MILANO: Yes, mineral insulated, yes. I don't remember the exact the material, but perhaps, Mr. Heibel would be able to provide that.

MEMBER STETKAR: I was going to ask, yes, what's that?

MR. HEIBEL: Aluminum oxide is the insulator that we're using.

MEMBER STETKAR: Aluminum oxide? What is -- I'm not a materials chemist person. How does that material respond under fire?

MR. HEIBEL: It has an extremely high temperature, but as you heat it up, leakage resistance does change.

MEMBER STETKAR: Does change?

MR. HEIBEL: Yes.

MEMBER STETKAR: I was going to ask, you know, your conclusion is that -- if I can jump ahead to slide 14, I think it says that there is no credible power fail -- no credible power cabling failure that would affect the CET signals.

MR. HEIBEL: Yes.

MEMBER STETKAR: I was curious whether they tried to burn those cables, to see whether that's a credible --

MR. RAHN: I don't believe that was part of the -- the testing that they did.

MEMBER STETKAR: Is -- has an evaluation of -- does -- let me ask the question.

Where in the terms of overall evaluation of this particular configuration does the question of possible fire damage --

MR. RAHN: It would be up --

MEMBER STETKAR: -- come up?

MR. RAHN: It would upstream in the --

MEMBER STETKAR: No, I --

MR. RAHN: -- in the plant, not in the mineral insulated cable line. The propulgation would occur in the power feed to the cabinet.

MEMBER STETKAR: No, no, I'm talking about, if you go back to slide 12, where the cable is co-located --

MR. RAHN: Yes.

MEMBER STETKAR: -- right there.

MR. RAHN: Yes.

MEMBER STETKAR: I don't know what the length of that run is, the physical length of the run, but if I have a fire, right, where the cursor was pointed --

MR. RAHN: Yes.

MEMBER STETKAR: -- and expose that cable to --

MR. RAHN: Yes.

MEMBER STETKAR: -- fire conditions, flame and temperature, how do I develop confidence that in deed, I will not have --

MR. RAHN: It is possible that you could damage that cable.

MEMBER STETKAR: Okay.

MR. RAHN: And it would be gone, you know.

MEMBER STETKAR: And where in TVA's submission for the licensing of this system, is that analysis provided?

MR. RAHN: Yes, the requirement for the post-accident monitoring system is that there be at least three thermo-couples in each quadrant available to perform the post-accident monitoring function.

MEMBER STETKAR: Okay.

MR. RAHN: And by loss of -- the way these are divided, they're alternating quadrants, and so, these are split into two separate cabinets.

You could actually lose one entire SPS cabinet and still fulfill the post-accident monitoring functions.

MEMBER STETKAR: What is the configuration of the seal table at Watts Bar, in any seal tables, all of the detectors come out in a -- you know, reasonably constrained, physical --

MR. RAHN: Yes, but it's --

MEMBER STETKAR: They're not distributed 25 degrees around the containment.

MR. RAHN: If you had a fire right at the seal table, it would be difficult to prove --

MEMBER STETKAR: And the question is, if that's the case, what is the length of those co-located cables runs?

I mean, do they go, you know, 50 meters through the containment before they finally split or is it, you know, two meters from the seal table?

MR. HEIBEL: Mike Heibel, again, at Westinghouse.

The wide cables, as we call the ones that have the split built into them, are approximately six feet in length.

MEMBER STETKAR: Six feet?

MR. HEIBEL: So, the split happens, rather soon, in a vicinity of the seal table itself.

The actual cables on the seal table itself, you go from left to right, for example, it's not all of one train is on one side, and one train is on the other.

They're mixed up in the seal table, in terms of how they're split out. So, it would have to be an event that would take --

MEMBER STETKAR: It would have to be a fairly -- fairly large fire -- I'm choking to death, but that's okay, fairly large fire located in the vicinity --

MR. HEIBEL: And in terms of the --

MEMBER STETKAR: -- of the seal table?

MR. HEIBEL: Each of these MI cables are steel jacketed, and they're tested to 400 degrees C. You know, that is pretty warm, that's clearly not, you know, as hot as you could get a fire.

MEMBER STETKAR: Right, right.

MR. RAHN: But there not much to burn in

that area.

MEMBER STETKAR: Okay, thanks.

CHAIR RAY: Were you -- yes?

MR. RAHN: Yes, that's all I have.

CHAIR RAY: Okay.

MR. RAHN: I'm sorry, I could just add, just for integrity purposes, we also looked at it from -- its qualification for EMI, RFI and seismic monitoring, as well, as the tests essentially showed that the cabinet won't fall apart, when it's subjected to the required response spectrum for the cabinet.

CHAIR RAY: Okay, thank you.

MEMBER BROWN: I did have one technical question, I'm not sure I understood your diagram on this, on page 12.

MR. RAHN: Yes.

MEMBER BROWN: If you can go back. After the split, you show -- you know, one side goes to the SPS, but the CET's go out, they're separate.

Now, that is all conversion. I know the straight thermo-couple signal goes all the way out. There is no other conversions until it gets to the Common Q cabinet?

MR. RAHN: Yes, that is right. That was an elimination of the cold junctions.

MEMBER BROWN: Okay, now, is the mineral insulated cable maintained all the way --

MR. RAHN: It's maintained up to the penetration.

MEMBER BROWN: Okay, just to the containment penetration?

MR. RAHN: Right.

MEMBER BROWN: And then you transfer to an organic or the --

MR. RAHN: Right.

MEMBER BROWN: -- the standard cable --

MR. RAHN: Thermo-couple.

MEMBER BROWN: -- with thermo-couple type cable, for that purpose?

MR. RAHN: Right.

MEMBER BROWN: Okay.

MEMBER SKILLMAN: May I ask you to confirm that the in-core system is independent from your standard NI's start up range intermediate range and power range?

MR. RAHN: Yes, yes, the NI's are fixed here. They're escorted.

MEMBER SKILLMAN: Thank you.

CHAIR RAY: All right, anything else, Patrick?

MR. MILANO: That concludes the morning portion of the presentation. This afternoon, we'll pick up with cyber security.

CHAIR RAY: And we will begin this afternoon's session by -- in a non-public format.

MR. MILANO: That's correct.

CHAIR RAY: All right, well, with that, then, we will adjourn until one o'clock.

(Whereupon, the above-entitled matter went off the record at approximately 12:00 p.m. and resumed at approximately 4:10 p.m.)

CHAIR RAY: Go ahead.

MR. MILANO: All right, I just wanted to lay out what the critical path is, in terms of the staff's review for Watts Bar Unit 2.

As we indicated this morning and as we saw from the fact that we were unable, because of time, to get into the accident transient analysis, you know, we do have some critical path items in that area.

As TVA indicated, the mass addition accident, the boron dilution is something that the staff hasn't completed its review of, and also, we're in the process right now of completing the dose consequence analysis in Chapter 15 Section 15.4.

Those items will -- are -- will be the

major portion of the non-programmatic reviews that we are going to be doing.

We did indicate to you that the fire protection program is currently ongoing. That is a major review that is scheduled to be completed by the staff in late January and also, we're in the final throes of preparing the draft supplement to the final environmental statement.

In that regard, the -- we have two more scheduled Subcommittee meetings, currently scheduled, and you know, December, we're going to meet in December 15th, and --

MR. SHUKLA: Fourteenth.

MR. MILANO: Excuse me, 14th?

CHAIR RAY: Well, I'll tell you something, I have been hammering on him, as he will readily confess, to move it back on day to the 15th.

So, I would be delighted with that, but it does mean I have to deal with my colleagues internal at the ACRS.

MR. MILANO: Okay.

CHAIR RAY: It's just on the record. I am just telling you that I would --

MR. SHUKLA: Can we discuss it?

CHAIR RAY: I'll be discussing it with my colleagues tomorrow, and it would help me a good deal, if we could do that. But anyway, go ahead.

MR. MILANO: Okay, as this slide indicates, we were thinking, as far as new material to be presented, we were going to discuss the operational and accident dose analysis rad-waste systems and stuff, in Chapters 11 and 12, and then also, as I indicated before, Section 15.4.

Now, that we -- now that the staff did not have a chance to present its findings on the accident transient analysis from the reactor side, we'll discuss that also during that meeting, and then as a follow on to the discussions on the hydrologic engineering area, we plan -- we will be planning to develop a presentation to give you a clearer understanding of how the staff came to its determinations in that area, with regard to flooding and the dams and stuff like that.

CHAIR RAY: That is fair.

MR. MILANO: And then our -- the last Subcommittee meeting that is currently scheduled is in April 2012, no date, no fixed date yet, and we were planning to cover fire protection in that meeting.

Now, in both of these, in both the December and the April meetings, as you indicated earlier, there are a number of open items that are still there, and what we will be doing is, is we will be -- as these items are worked off, we will be presenting those to you, and those items that are of a non-confirmatory nature, those wherein the staff had to write something in its SER to show its final conclusion.

So, we'll be discussing open items in both of these. I didn't put it down here because we don't know for sure, which ones are going to be -- will be done by -- in each one of those times.

MR. SHUKLA: So, Pat, just to make sure, are we discussing cyber-security in the December meeting or not?

MR. MILANO: No, we'll have to work it out with you, as to what --

CHAIR RAY: The way I'd leave it on that is, if we can't achieve the understanding and comfort level, I'll call it, that I referred to in the discussion here over how all this gets verified, it will just be a comment in our letter that says, this is an area that's got to be resolved.

It does apply to more than Watts Bar Unit 2. I would rather get it resolved here, so we don't have to that, because it's just another thing that has to go out and be tracked around and somehow, dealt with.

So, I'd rather that we are able to say, yes, we understand and present it to the full Committee and get their understanding and acceptance, in the context of Watts Bar Unit 2.

But at the end of the day, because it does apply to more than Watts Bar Unit 2, we can also just note in the letter that we haven't achieved resolution on the issue of verification of -- it is very similar, as I said, to DAC.

We don't like DAC. I don't think the staff likes DAC, because you set criteria and you have no way of being sure that you've got the criteria precisely correct, and that they can't be interpreted in different ways.

Licensees don't like DAC either, for that same reason.

So, enough said. I don't want to take anymore time.

MR. SHUKLA: So, the full Committee is scheduled in May.

MR. MILANO: That is correct.

CHAIR RAY: Well, I got a feeling there is likely to build up a need for more than the two meeting days that you just mentioned, Pat. I don't know, I don't want to predict that, but just my gut tells me, that we're not going to get through the agenda that you're referring to in a one-day in December, either.

But some of my colleagues are not here, like Professor Banerjee and so on, will help me understand that better.

CHAIR RAY: Okay.

MEMBER STETKAR: Pat, is the -- just I haven't looked at it, the fire protection stuff, 1.189, I mean, is it a straight deterministic --

MR. MILANO: Yes, that is correct.

MEMBER STETKAR: Without too many --

MR. MILANO: Yes.

MEMBER STETKAR: -- innovative -- okay.

MR. SHUKLA: Yes, are they going to --

MEMBER STETKAR: I know that, it's just a question of, given the history of the -- whether the -- okay.

MR. MILANO: Let's get over to 28, and again, just -- you know, I think we've provided you with an overview of where the project currently stands, and we also discussed each one of these, you know, what our future milestones are, for both the meeting with this staff, and also, there is a hearing that is pending, waiting for the completion of the final environmental statement, and so, that is still out there.

Then I just put down operational readiness assessment and certification of as-built. Those are pretty standard and common.

We have a detailed flow description that we've shared between us and TVA, which lays out what is remaining to be completed, in terms of major milestones between now and the time when the staff would be able to go to the Commission.

CHAIR RAY: Okay, well --

MR. MILANO: And that pretty much --

CHAIR RAY: If you look at two one-day Subcommittee meetings, and you try and allocate out the time involved in the things you have to go, I just don't think you conclude that it's doable. That's my opinion.

What that means is, we want to avoid spending time on, at times today, things that were not very productive.

Now, the discussion, I thought TVA's contribution on cyber-security was very responsive, and obviously helpful to the understanding and so on.

That's an example of where we need to focus in on things that are likely to be problematic, okay, and not spend time, because two days go by so fast, that I may be mistaken, it may be that we get through the things that we need to get through in those two days, without any trouble.

But I'm just not all that optimistic about it, and in any event, let's make sure we don't spend time on things that we don't need to spend time on, and make sure we get stuff sufficiently in advance, that we are able to distribute it to people and like I say, one of my problems is getting the right people to the right Subcommittee meetings, and having visibility therefore, to what topics are going to be at which of these two meetings is critical.

Okay, anymore, Pat?

MR. MILANO: No, but in preparation for the December one, you know, on or before December 15th, excuse me, November 15th, we will have the next supplement to Mr. Girija.

CHAIR RAY: All right. We'll count on it.

MR. SHUKLA: And any FSAR?

MR. MILANO: Right.

CHAIR RAY: All right, with that, Charlie, do you have anything more you want to contribute?

MEMBER BROWN: No.

CHAIR RAY: All right, Dick, anything you want to say?

MEMBER SKILLMAN: No, thank you.

CHAIR RAY: John?

MEMBER STETKAR: No.

CHAIR RAY: Mike?

MEMBER RYAN: No.

CHAIR RAY: Okay, well, with that, then, we'll consider this meeting concluded. We look forward to whichever those two days in December we finally land on. Thank you.

(Whereupon, the above-entitled matter concluded at approximately 4:20 p.m.)

ACRS Subcommittee Meeting Regarding

Watts Bar Nuclear Plant Unit 2

Status of Licensing and Inspection

Docket No. 50-391

October 5, 2011

U.S.NRC
United States Nuclear Regulatory Commission
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Agenda Topics

- **TVA**
  - Construction Completion Status
  - Hydrology (FSAR 2.4)
  - Reactor (FSAR Chapter 4)
  - In-Core Instrumentation (FSAR 7.7.1.9)
  - Accident and Transient Analyses (FSAR Chapter 15)
  - Cyber-Security (FSAR 13.6.6; Closed Session)
- **NRC**
  - Status of Licensing and Construction Inspection
  - Supplements 23 and 24 to SER
  - Remaining Safety Review Activities

NRR Presentation of Status of Licensing Activities

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Status of Operating License Application

- TVA amendments to FSAR received (A92 to A106)
- Supplements to original Safety Evaluation Report
  - SSER 21 - identifies regulatory framework
  - SSER 22 – FSAR Chapters 2, 3, 5, 6, 8, 9, 10, 13, 14, 17
  - SSER 23 – FSAR Chapters 4, 7
  - SSER 24 – FSAR Chapters 2.4, 11, 12, 13.6.6, 15
- Major Review Areas Remaining
  - Fire Protection Report
  - Accident dose consequences
  - Closure of open items from SER review
  - Complete draft supplement to final environmental statement

Safety Evaluation Report Supplements (SSERs)

- SSER 23 Published July 2011
- SSER 24 Published September 2011

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Section 2.4, Hydrologic Engineering

- Increase in Probable Maximum Flood (PMF) level, but margin remains
- Credit for temporary dam modifications (sand baskets)
  - PMF analysis and the seismic dam failure analysis credit an increased height of embankment at four dams (Fort Loudoun, Tellico, Cherokee, and Watts Bar)
  - Increased height prevents overtopping and failure of embankments during a PMF event
  - Reservoir headwaters will not have reached bottom elevation of the sand baskets; therefore, a hydrodynamic loading condition, as a result of a seismic event, does not apply
- TVA to confirm sand baskets meet or exceed the acceptable stability factors of safety

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Section 2.4, Hydrologic

- Open Items remaining for Staff review
  - TVA to perform either hydrology analysis without crediting use of the sand baskets at the Fort Loudoun dam for the seismic dam failure and flood combination, or perform a seismic test of the sand baskets
  - Justification for dams not to fail for OBE (0.09g)
- Staff proposed 2 License Conditions
  - Address how the pre-established acceptance criteria were met by August 31, 2012
  - Long-term modification plan shall be completed within three years from the date of issuance of the operating license

Section 4, Reactor

- Fuel Design
  - Unit 1 transition from Vantage 5H to RFA-2 fuel (Amendment 46; 2003)
  - Unit 2 core will be all new fuel of RFA-2. No substantive differences.
  - No tritium producing burnable absorber rods
- Design bases and functional requirements used in the nuclear design of the fuel and reactivity control systems
  - Thermal performance and thermal conductivity (open item)
  - Mechanical performance bounded by prior analyses
- Thermal-Hydraulic Design

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In-Core Instrumentation System

- Composed of Westinghouse In-Core Instrumentation Surveillance and Engineering (WINCISE) System
  - Used to produce continuous core power distribution measurements using the BEACON-TSM system software package
  - WINCISE system consists of 58 Incore Instrument Thimble Assemblies (IITA), each with Five (5) self-powered Vanadium detector (SPND) elements and one (1) ground junction core-exit thermocouple.
  - The SPND elements output current values are directly proportional to the local neutron flux
  - The CET output voltage signals are related to the local temperature
  - The SPND signals are processed for use by BEACON-TSM power distribution monitoring system (PDMS) to generate continuous 3-D core power distribution.

In-Core Instrumentation System

- WINCISE system is an upgrade of WBN Unit 1 moveable incore detection system and its top mounted CETs
- Vanadium SPND elements have a lifetime of 20 reactor years as opposed to shorter lifetime of Rhodium detectors
- The PDMS software monitors the reactor operating limits defined in TS when the reactor is operating above 20% of Rated Thermal Power.
- BEACON-TSM calculation is performed using NRC-approved nodal method
- BEACON-TSM methodology provides procedure to calculate Power Peaking Factor uncertainty
- WBN 2 BEACON system continuously adjusts both axial and nodal calibration factors using the data from the SPND signal measurements

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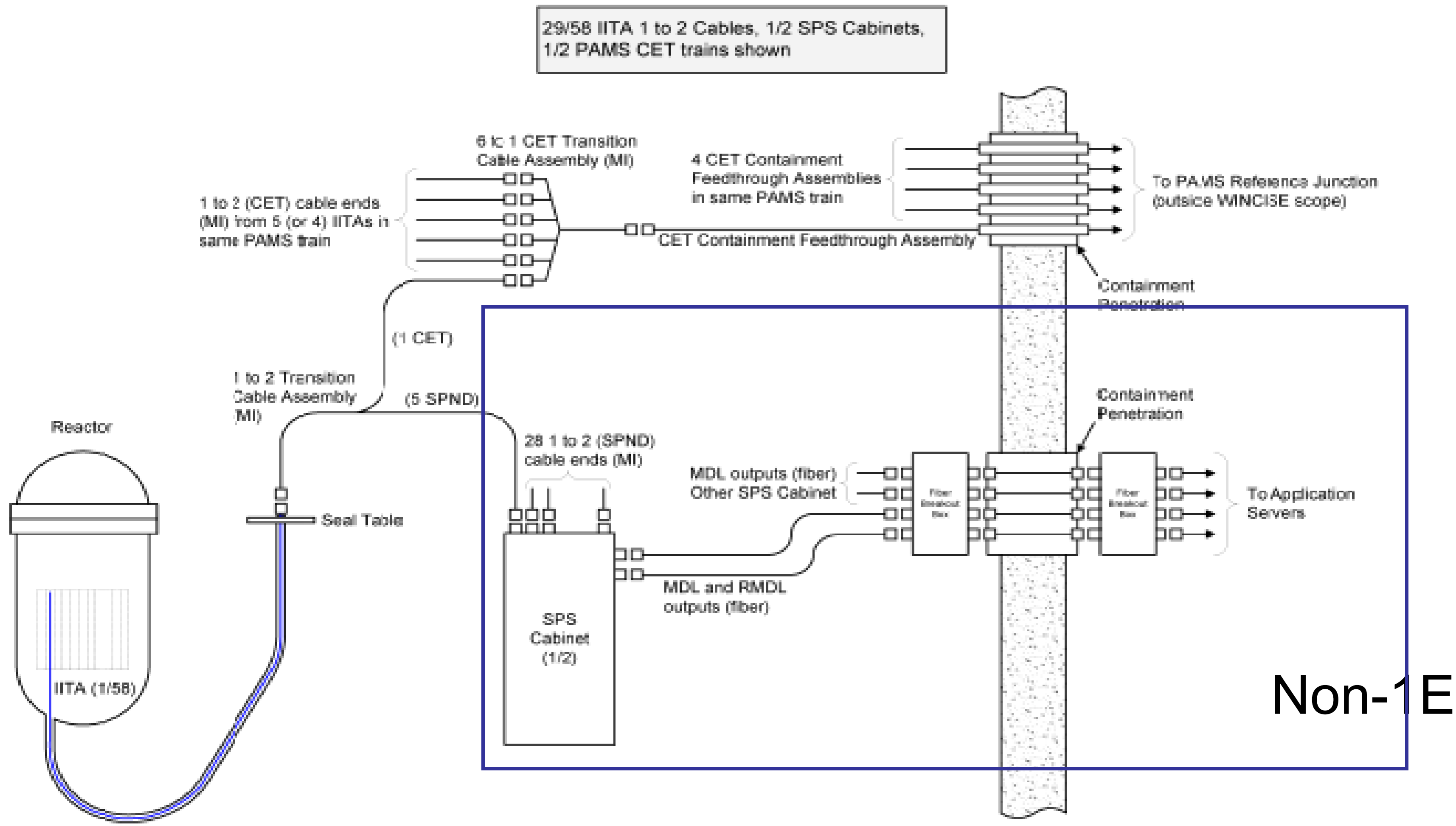
In-Core Instrumentation System

- **Scope of Evaluation of Instrumentation**
  - Differences in the WBN 2 design from that of Unit 1
  - 10 CFR 50.55a(h) Codes and Standards Compliance
  - SRP Section 7.7, “Control Systems” Review Acceptance Criteria
  - Potential Class 1E to Non-1E Interactions (R.G. 1.75)
    - IEEE Std. 279-1971 (Power Supply for WINCISE)
    - IEEE Std. 603-1991 (PAMS)
    - IEEE 384-1981 Independence Criteria
  - Equipment Qualification—Seismic

Class 1E to non-1E Separation/Isolation



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Scope of Staff Evaluation

- Neutron Detectors and CETs are electrically separated, but physically located within the same IITA.
- The NRC staff performed an evaluation of the IIS against the independence criterion. Specifically, staff evaluated the licensee's analysis description and supporting documents demonstrating that credible faults originating in, or by means of, the non-1E portion can not adversely affect the operation of the Class 1E CETs.
- Staff also evaluated the licensee's demonstration that the WINCISE SPS cabinet seismic qualification is sufficient to demonstrate that credible seismic events will not cause failures within the cabinet from adversely affecting the mineral insulated cables containing the Class 1E CETs.

Staff Findings and Conclusions

- The Westinghouse analysis submitted by TVA showed that no credible power cabling failure originating within the WINCISE system can result in a propagated fault with a voltage level sufficient to affect the CET signals.
- The Westinghouse seismic qualification results showed that the WINCISE cabinet maintains structural integrity during application of the seismic test qualification level response spectra for 5 OBEs + 1 SSE without any component detachments
- The NRC staff concludes that the IIS conforms to the applicable requirements of 10 CFR 50.55a(h) as defined in IEEE Std. 279-1971 Clause 4.7, “Control and Protection System Interaction, “IEEE Std. 603-1991 Clause 5.6.3, “Independence Between Safety Systems and Other Systems,” and IEEE Std. 603-1991 Clause 6.3, “Interaction Between the Sense and Command Features and Other Systems.”

Section 15, Transient and Accident Analyses

- **Agenda Topics**
  - Review Procedures
  - General Results
  - Challenging Review Areas
  - Conclusions

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Review Procedures

- Reference the licensing basis of Watts Bar Unit 1
- Ensure that analytic methods are used within the limits of the staff's approval
- Compare results to similar plants
- Additional information was requested to aid in the review of challenging areas:
  - Several rounds of RAIs were issued
  - Additional analyses were requested
  - Two audits were conducted
    - First audit – March 15th in Rockville, MD
    - Second audit – June 28 through 30 in Cranberry, PA

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General Results

- Most results were acceptable w/o further information
  - Analyses performed using NRC-approved methodology
  - Analyses were continually reviewed since the Unit 1 application
  - Results acceptable with margin to acceptance criterion or regulatory limit
- Results for five accident analyses presented some review challenges

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Challenging Review Areas

– 1. Overpressure protection analysis

– 2. CVCS malfunction event

– 3. Inadvertent ECCS actuation at power

– 4. Boron dilution in Modes 3, 4,and 5

– 5. Main steam line break

1. Overpressure Protection

- SRP 5.2.2 specifies that adequate overpressure protection be demonstrated for the limiting event (loss of load)
- Analysis should be based upon a reactor trip from the 2nd trip signal
- Analysis was based upon reactor trip from 1st trip signal
- TVA re-analyzed the loss of load, assuming reactor trips on the 2nd trip signal
- Results of re-analysis show that RCS and MSS pressure safety limits are not exceeded

2. CVCS malfunction event

- CVCS malfunction event was not in the FSAR (i.e., it was omitted)
- The event is listed in RG 1.70, Rev 2
- The event is not bounded by the inadvertent ECCS event
- TVA provided an analysis
- Results indicate there is adequate time for manual mitigation

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3. Inadvertent ECCS actuation

- Analysis was unacceptable, as explained in RIS 2005-029
- TVA provided a re-analysis
- Results indicate there is adequate time for manual mitigation

4. Boron Dilution in Modes 3, 4, and 5

- RG1.70, Revs 0 and 1, required explicit Boron Dilution calculations in Modes 1, 2 and 6. Subsequent revisions RG 1.70 added requirements to consider in all 6 modes
- SRP 15.4.6 calls for analysis of event in all modes
- Analyses inconsistent with SRP since only Modes 1, 2, and 6 analyzed
- Open Item for TVA to provide analyses of boron dilution event that meet the criteria of SRP Section 15.4.6, including
  - Description of the methods and procedures used by the operators to identify the dilution path(s) and terminate the dilution in order to determine analyses comply with GDC 10
  - Time available for manual action begins at start of event

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5. Main Steam Line Break

- Results were too good (compared to similar plants)
- Results were inconsistent with the conclusions of WCAP-9226
- Results were deconstructed, at the 2nd audit, to explain the contribution of each key assumption and parameter
- A new limiting-case analysis was provided

Staff Review Conclusions

- Staff draws a reasonable assurance conclusion with the same, or higher confidence, as compared to the Unit 1 review
- Some changes in the Unit 2 licensing basis must also apply to the Unit 1 licensing basis
- Westinghouse’s steam line break analysis methods should be updated

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Critical Path Items

- Accident and Transient Analyses
  - Mass addition accidents – boron dilution
  - Dose consequences analysis
- Fire Protection Program
- Supplement to Final Environmental Statement

Schedule

- ACRS Subcommittee Meetings
  - December 2011 – Operational and Accident Dose (11, 12, 15.4)
  - April 2012 – Fire Protection

Project Summary of Watts Bar Unit 2 Remaining Activities

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Project Status

- Staff review nearing completion
- Future Milestones
  - Complete SER and SFES-OL
  - Complete ACRS Review
  - Conduct hearing and ASLB provide decision
  - Operational readiness assessment
  - Certification of as-built construction

Expectations for Next Meeting

- Scheduled for December 2011
- Accident Dose Consequence Analyses
- Radioactive Waste Management
- Radiation Protection

NSIR Presentation on Cyber-Security Plan Watts Bar Unit 2

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REGULATORY EVALUATION

- TVA submitted the WB2 CSP and implementation schedule per 10 CFR 73.54
- Submission was found acceptable IAW LIC 109
- TVA responded to three generic RAIs
- TVA worked with staff to resolve implementation schedule issues

RG 5.71 AND NEI 08-09, REV. 6

- RG 5.71 is one way for licensees to meet the requirements of 10 CFR 73.54
- NRC staff found NEI 08-09 Revision 6 acceptable (but not endorsed) for use by licensees to meet the requirements of 10 CFR 73.54
- RG 5.71 and NEI 08-09, Revision 6 are comparable documents
- TVA submitted WB2 CSP was reviewed against the corresponding sections in RG 5.71

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WB2 CSP ELEMENTS

Scope and Purpose	Ongoing Monitoring and Assessment
Analyzing Digital Computer Systems and Networks and Applying Cyber Security Controls	Modification of Digital Assets
Cyber Security Assessment and Authorization	Attack Mitigation and Incident Response
Cyber Security Assessment Team	Cyber Security Contingency Plan
Identification of Critical Digital Assets	Cyber Security Training and Awareness
Examination of Cyber Security Practices	Evaluate and Manage Cyber Risk
Tabletop Reviews and Validation Testing	Policies and Implementing Procedures
Mitigation of Vulnerabilities and Application of Cyber Security Controls	Roles and Responsibilities
Incorporating the Cyber Security Program into the Physical Protection Program	Cyber Security Program Review
Cyber Security Controls	Document Control and Records Retention and Handling
Defense-in-Depth Protective Strategies	Implementation Schedule

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CYBER SECURITY ASSESSMENT AND AUTHORIZATION

- Although the WB2 CSP deviated from the template, staff found the deviation acceptable because the CSP adequately established controls to develop, disseminate, and periodically update the cyber security assessment and authorization policy and implementing procedure.

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DEFENSE-IN-DEPTH PROTECTIVE STRATEGIES

- WB2 CSP allows only deterministic one-way flows from Level 3 to Level 2, effectively isolating Levels 3 and 4 from the lower levels
- Information flows between Level 3 and Level 4 are restricted through the use of either:
  - (1) one or more deterministic devices (data diodes or air gaps); or
  - (2) firewall(s) and network-based intrusion detection system(s)
- WB2 CSP is comparable to the regulatory guidance
- Staff found the CSP adequately describes implementation of defense-in-depth protective strategies.

DOCUMENT CONTROL AND RECORDS RETENTION AND HANDLING

- Initial industry guidance did not meet the requirements of 10 CFR 73.54
- Subsequent industry guidance was provided that did meet the requirements of 10 CFR 73.54
- In response to an RAI, the WB2 CSP was supplemented to be comparable regulatory guidance without deviation and the NRC staff found the CSP adequately describes cyber security document control and records retention and handling.

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IMPLEMENTATION SCHEDULE

- Establish the Cyber Security Assessment Team (CSAT);
- Identify CSs and CDAs;
- Install a deterministic one-way device between lower level devices and higher level devices;
- Implement the security control “Access Control For Portable And Mobile Devices”;

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IMPLEMENTATION SCHEDULE

- Implement observation and identification of obvious cyber related tampering to existing insider mitigation rounds by incorporating the appropriate elements;
- Identify, document, and implement cyber security controls for CDAs that could adversely impact the design function of target set equipment;
- Commence ongoing monitoring and assessment activities for those target set CDAs whose security controls have been implemented.
- Full Cyber Security Program implementation

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IMPLEMENTATION SCHEDULE

- The WB2 CSP implementation schedule stated that an upgrade to two systems common to the operations of both WB1 and WB2 would not be deployed prior to the WB2 fuel load and reactor startup.
  - the security computer system; and
  - the corporate-wide emergency preparedness system.

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IMPLEMENTATION SCHEDULE

- WB2 Emergency Preparedness systems and Security Computer will be fully compliant with 10 CFR 73.54 by the full implementation date provided in the WB1 CSP implementation schedule.
  - License conditions are provided for the EP systems and the Security Computer
- All other portions of the WB2 CSP are scheduled to be implemented prior fuel load.
- Based on the WB2 CSP provisions ensuring timely implementation of protective measures and supporting license conditions, the NRC staff found the WB2 CSP implementation schedule satisfactory.

TENNESSEE VALLEY AUTHORITY
WATTS BAR NUCLEAR PLANT UNIT 2

WBN Unit 2 ACRS Presentation

October 5, 2011

Agenda

- Agenda Overview - Dave Stinson
- Reactor Fuels (FSAR Chapter 4) – Robert Bryan
- Transient Analysis (FSAR Chapter 15) – Robert Bryan
- Hydrology (FSAR Chapter 2.4) – Penny Selman
- Special Topics
    - WINCISE – Steven Hilmes
    - Cyber Security – Laura Snyder & Steven Hilmes
- Questions

Reactor Fuels
(FSAR Chapter 4)

Chapter 4 Fuel

- Updated Fuel Design
  - Robust Fuel Design RFA-2 vs. VANTAGE 5H
  - Debris Filter Bottom Nozzle
  - ZIRLO® Clad
- Low Leakage Core
- Major Differences to Unit 1
  - No Tritium
  - Fixed Incore Detectors
- Thermal Conductivity
  - Generic Industry Issue
  - License Condition to Follow Industry Approach

Transient Analysis
(FSAR Chapter 15)

Chapter 15 Transient Analysis

- Unit 2 Analyses Generally Similar to Unit 1 at OL
  - Original Steam Generators
  - No Measurement Uncertainty Recapture
- LBLOCA & SBLOCA have large margins to PCT Limit of 2200^{o}F
  - ASTRUM vs. Appendix K Model

Chapter 15 Transient Analysis

- New Analysis
  - Overpressure Protection on Second Trip
  - CVCS Malfunction that Increases Reactor Coolant System Inventory
  - MSLB Analysis and Parameter Sensitivity Study
- Additional Analyses
  - Inadvertent ECCS – no Liquid Release from PORVs
  - Boron Precipitation
- Open – Boron Dilution Modes 3, 4, 5
  - Same as Unit 1
  - Providing additional information

Hydrology
(FSAR Chapter 2.4)

Chapter 2.4 Hydrology

Background

- Watts Bar Designed in Accordance with Regulatory Position 2 of Regulatory Guide 1.59, Revision 2, August 1977
- Design and Licensing Basis Assumes Floods and Combination Flood and Seismic Events Exceed Plant Grade
- Emergency Protective Measures are In-place To Assure Protection Of Public Health and Safety in the Event of Flooding that Exceeds Plant Grade

Chapter 2.4 Hydrology

Background

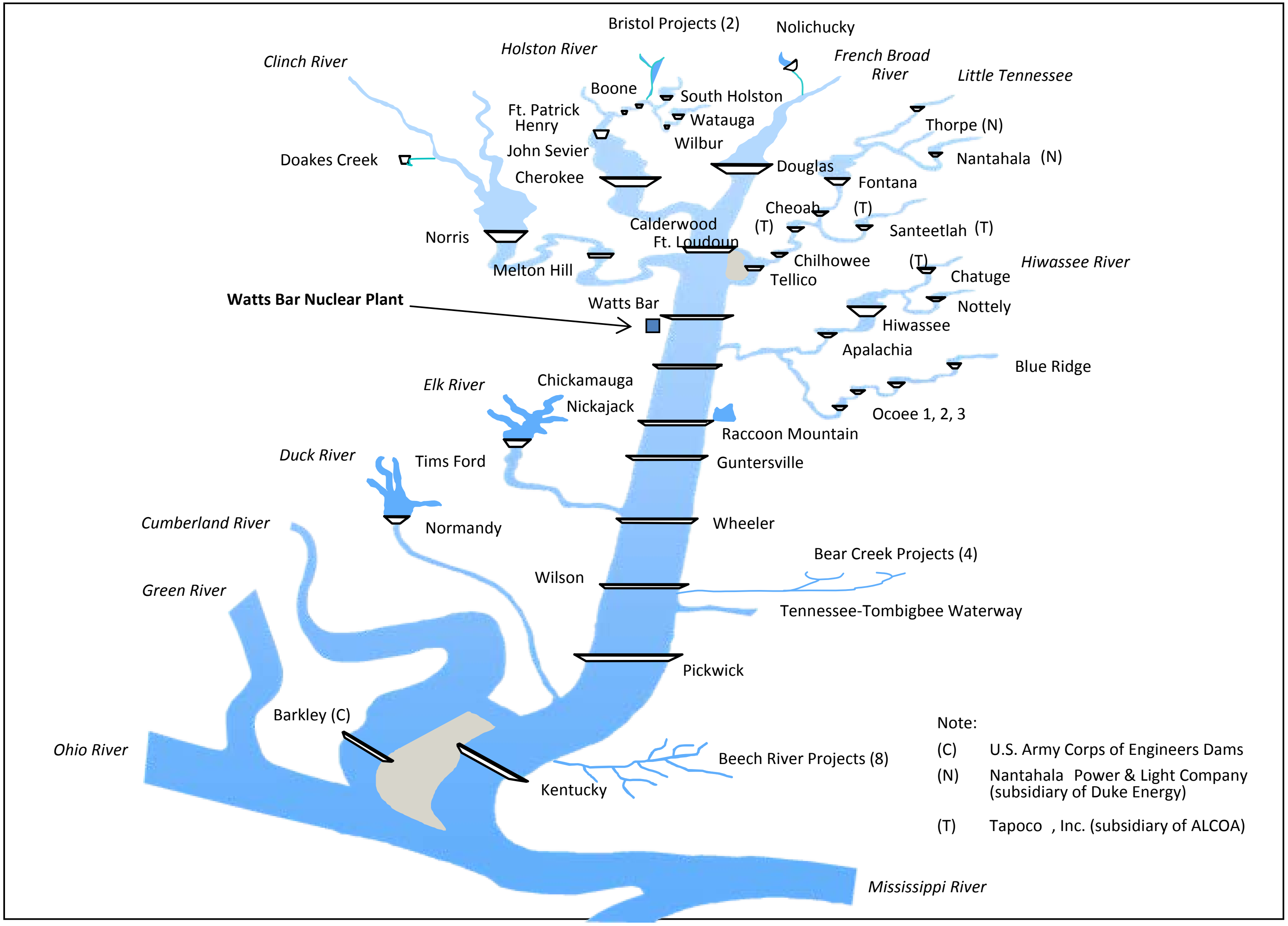
- TVA utilized results from an updated hydrology calculation (*circa* 1998) for Bellefonte COLA
  - A February 2008 NRC Inspection Identified Concerns
- The calculation had been used as a basis for UFSAR Section 2.4 revisions
  - Watts Bar initiated UFSAR changes in 1998
    - Original analysis: PMF elevation 738.1
    - 1998 PMF analysis results: PMF elevation 734.9
- TVA initiated hydrology project in March 2008
  - Validate and verify legacy hydrology software
  - Verify or regenerate all model inputs

Chapter 2.4 Hydrology

Watts Bar Hydrology Analysis

- Probable Maximum Flood (PMF) (FSAR Section 2.4.3)
- Potential Seismic Dam Failures with Smaller Floods (FSAR Section 2.4.4)
- Warning Time Assessment (FSAR Section 2.4.10)
- Loss of Downstream Dam (FSAR Section 2.4.11)

River System Schematic



Note:
(C) U.S. Army Corps of Engineers Dams
(N) Nantahala Power & Light Company (subsidiary of Duke Energy)
(T) Tapoco , Inc. (subsidiary of ALCOA)

Chapter 2.4 Hydrology

- Analysis Results
  - PMF elevation 738.8
  - Wind wave recalculated, average 2.5’
  - SSE + 25 year
    - Norris, Cherokee, Douglas & Tellico Dams fail from SSE combined with 25 year flood = 731.1’ (bounded by PMF elevation)
  - OBE + 1/2 PMF
    - Norris & Tellico Dams fail from OBE combined with ½ PMF flood = 728.8’ (bounded by PMF elevation)

Chapter 2.4 Hydrology

- Analysis Results
  - Warning Time Assessment Verification
    - 27 hours verified as adequate minimum time
      - Summer and Winter storms evaluated for PMF
      - Seismic dam failure with smaller floods also evaluated
      - Shortest arrival time from dam failure = 28 hours
  - Loss of Downstream Dam Verification
    - Verified adequate time available to provide release from upstream dam to provide sufficient elevation for cooling

Chapter 2.4 Hydrology

- What caused the increases in flood level?
  - River Operation changes
    - Tributary reservoir levels higher
  - Reassessment of Operational Allowances
    - Amount of surcharge of tributary projects assumed during PMF conditions
  - Spillway coefficients
    - Textbook values vs. model test data

Chapter 2.4 Hydrology

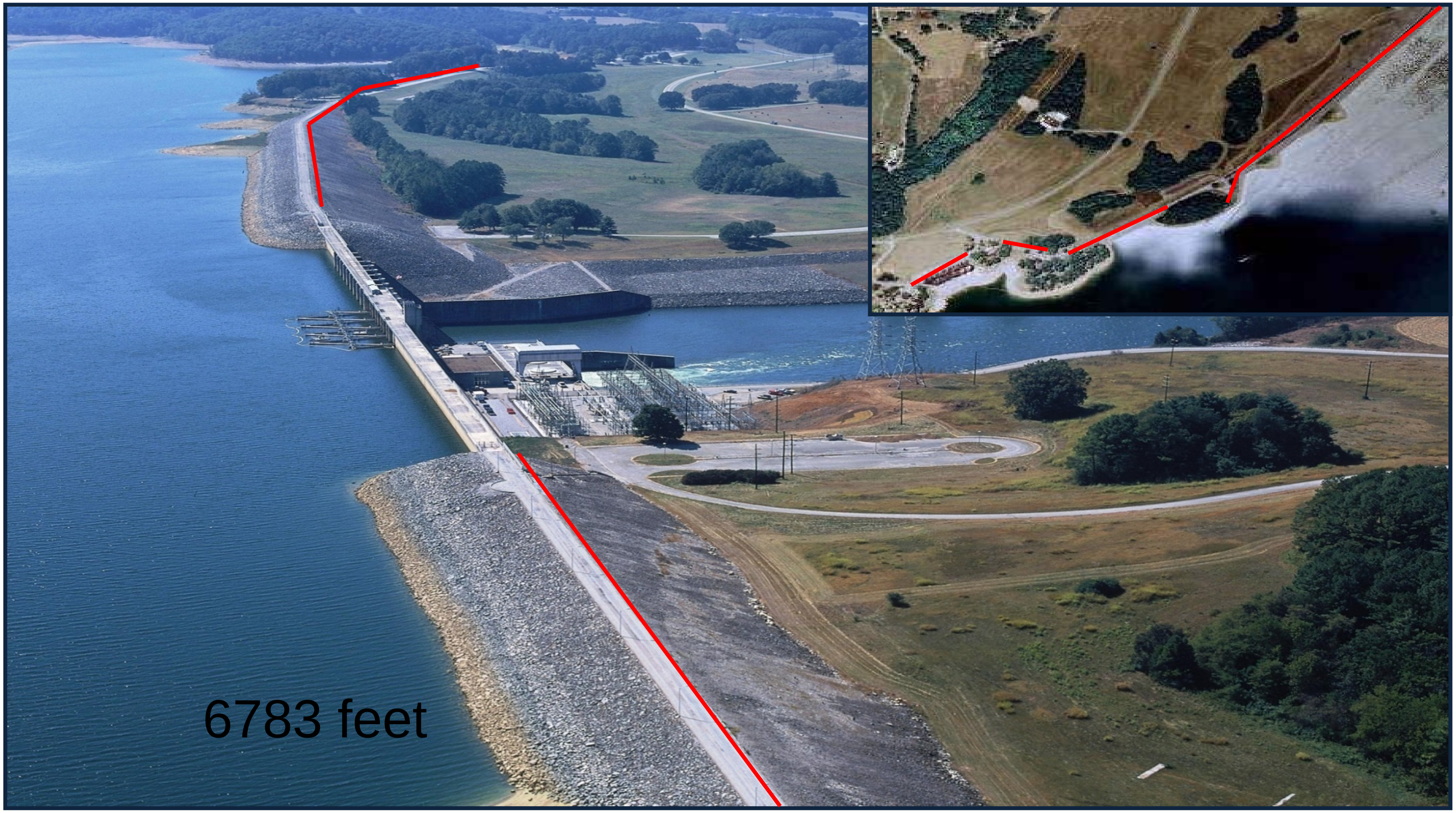
- Emergency Preventative Measures
  - HESCO bastions
  - Four upstream dams protected
    - Watts Bar
    - Fort Loudoun
    - Tellico
    - Cherokee

Chapter 2.4 Hydrology

Dam	New PMF (HW) (ft)	New PMF (TW) (ft)	Current Elevation (ft)	New Elevation (ft)
Watts Bar	768.3	739.0	767.2	770.2
Fort Loudoun	835.65	821.2	833.3	837.6
Tellico	833.3	820.3	830.5	834.5
Cherokee	1090.7	981.5	1089	1092

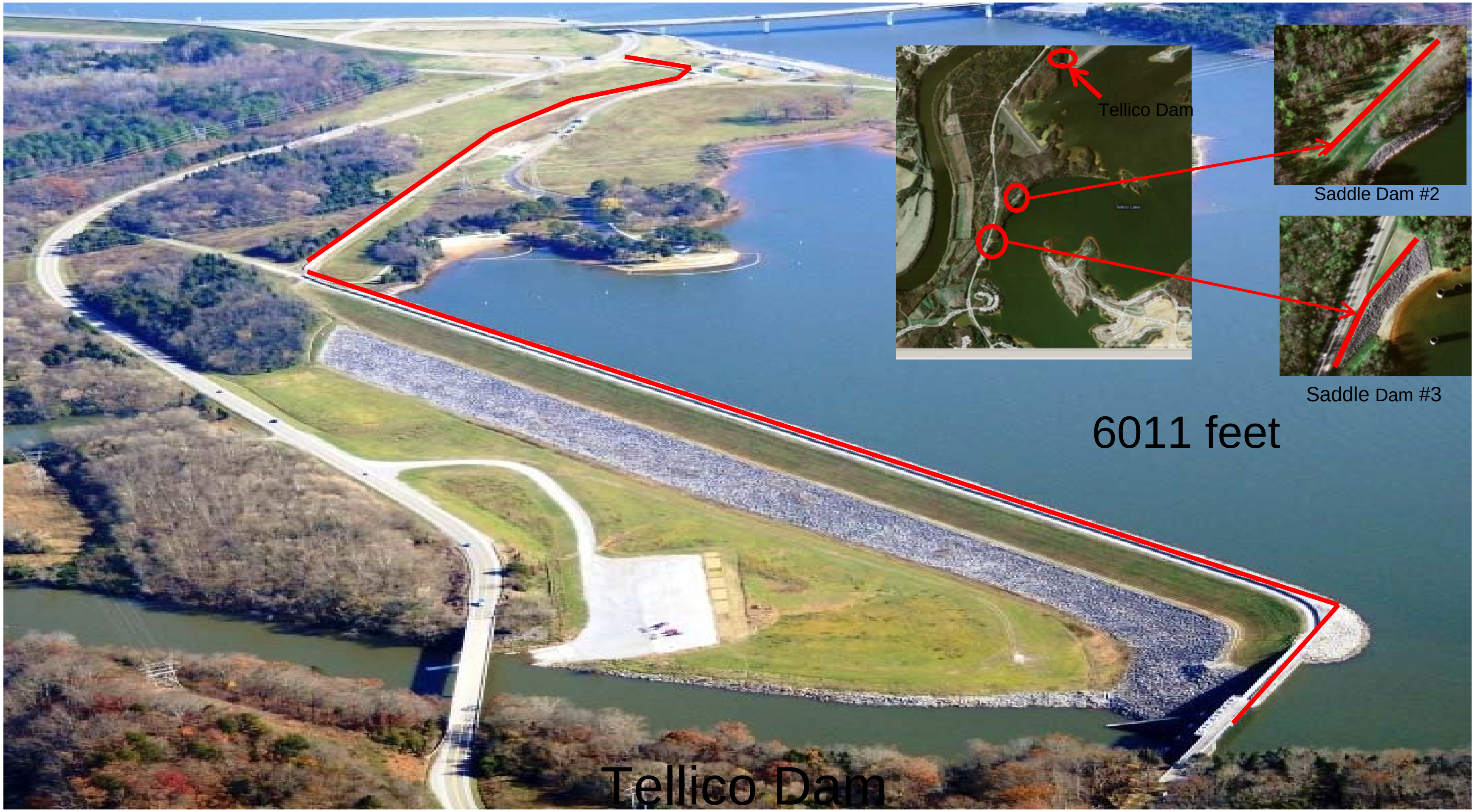
Total raised	HESCO baskets	Sand Used
18,200 feet	6,900	30 Million pounds

Cherokee Dam



Cherokee Dam

Tellico Dam



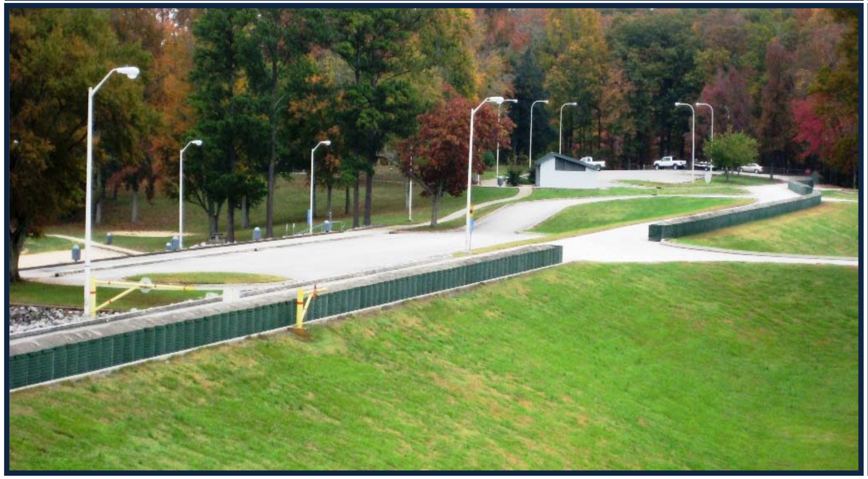
Tellico Dam

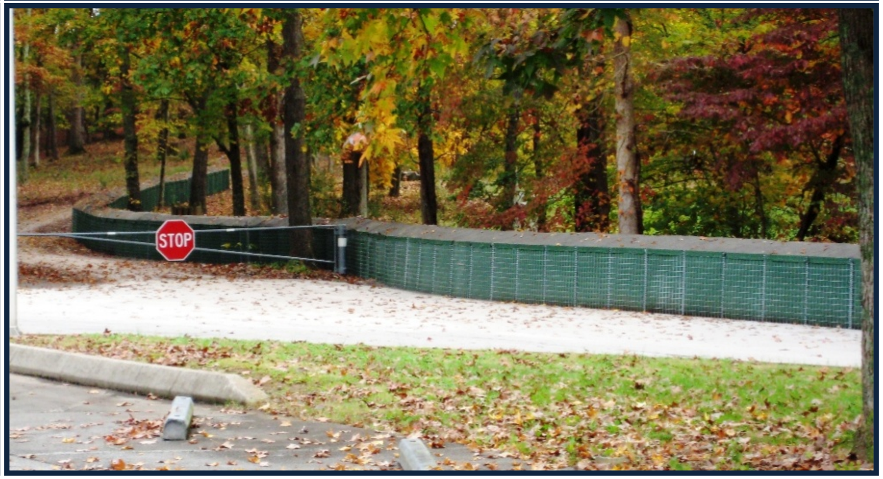
Fort Loudoun Dam

Fort Loudoun Dam

Watts Bar Dam

Watts Bar Dam





Watts Bar Dam

Remaining mats to be covered with soil

Chapter 2.4 Hydrology

Cherokee & Douglas Dams

- Dam stability evaluated for increased headwater and tailwater elevations at all modified projects
- Cherokee and sister dam, Douglas, posed challenges using simplified analysis
  - Challenges with cracked base
  - Sliding factors of safety and overturning adequate
- Detailed finite element analysis ongoing

Chapter 2.4 Hydrology

- Additional protection at Watts Bar Nuclear
  - Thermal Barrier Booster Pumps
    - Required for flood mode
    - Currently margin exists to protect pumps in flood
    - Additional margin desired
    - Pursuing High Temperature Reactor Coolant Pump Seals

Chapter 2.4 Hydrology

- Watts Bar Unit 2 Commitments
  - Hydrology analysis of Seismic Dam Failures with Smaller Flood without HESCO barriers or seismic test of HESCO barriers – October 31 ,2011
  - Continue to maintain and inspect the HESCO barriers until implementation of permanent solution at all four dams
  - Provide update to WBN Unit 2 FSAR to describe long-term stability analysis methodology following completion of finite element analyses by August 31, 2012

Special Topics
WINCISE

WINCISE

System Purpose

- WINCISE is a Non Safety Related fixed core instrumentation system which provides mapping of neutron flux within the core in order to calculate power distribution.

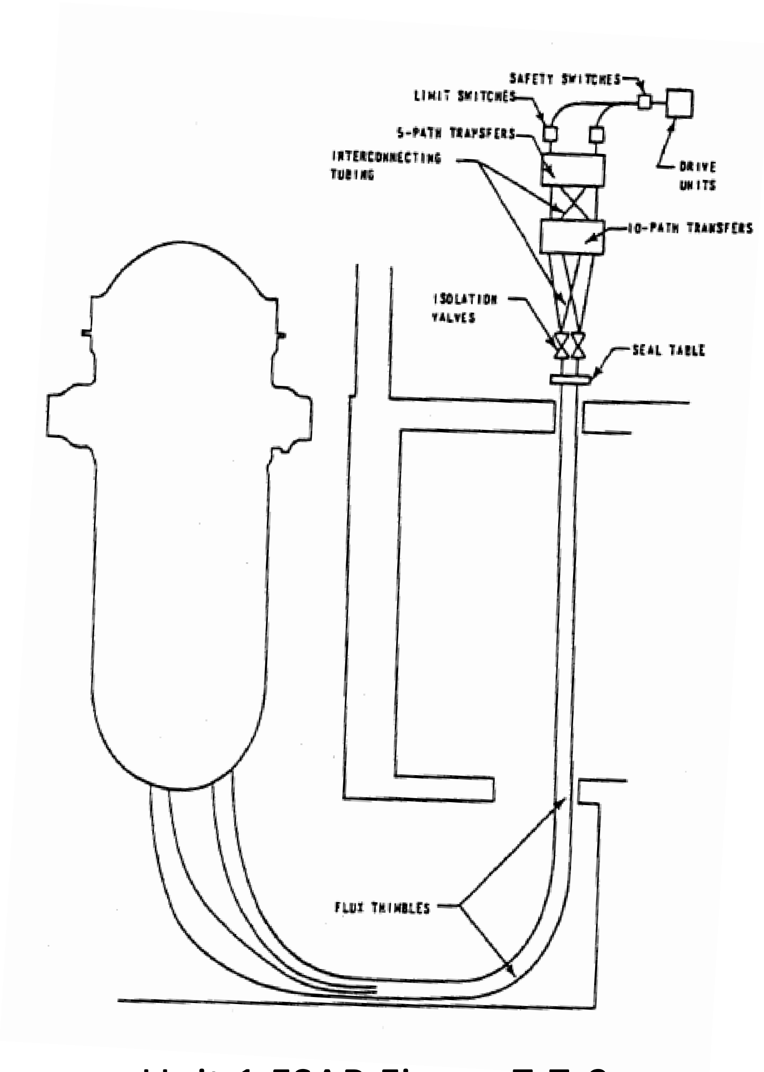
- The Incore Instrument Thimble Assemblies (IITA's) also contain the Core Exit Thermal Couples (CET) which are required for Post Accident Monitoring.

WINCISE

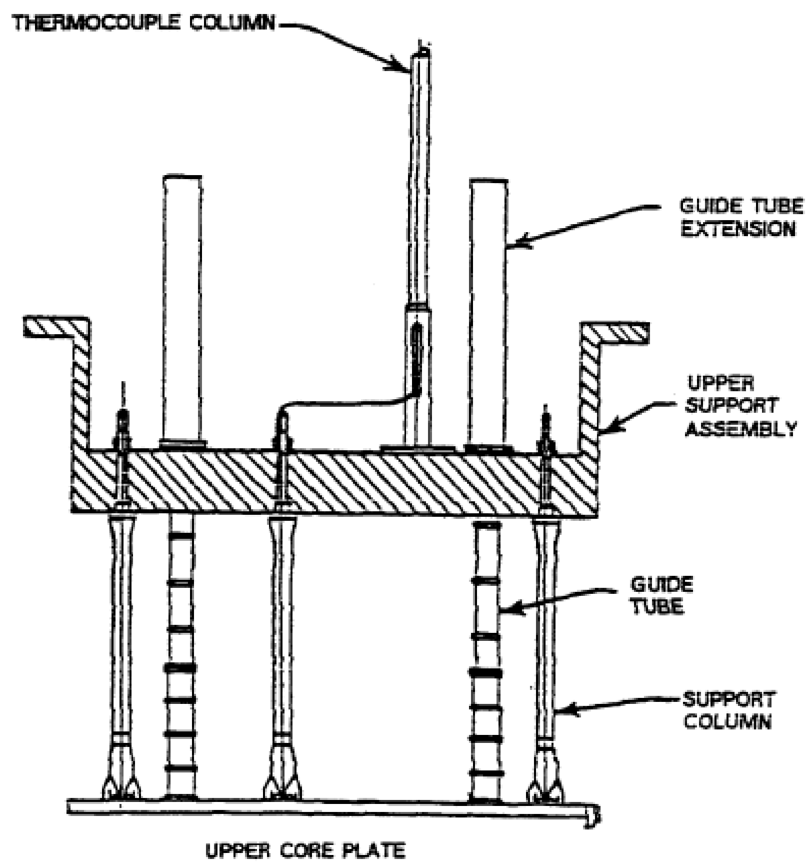
Background

- Watts Bar Unit 1
  - Moveable Incore Detector System (MIDS)
    - 6 U235 Detectors
    - Controls and Recorders in Main Control Room (MCR)
  - Top Mounted Core Exit Thermocouples (CET)
    - 65 top mounted Type-K CETs
    - Reference Junction Box inside containment

WINCISE



Unit 1 FSAR Figure 7.7-9



Unit 1 FSAR Figure 4.2-11

WINCISE

Westinghouse **INC**ore **I**nformation, **S**urveillance, and **E**ngineering **(WINCISE)** System

Watts Bar Unit 2

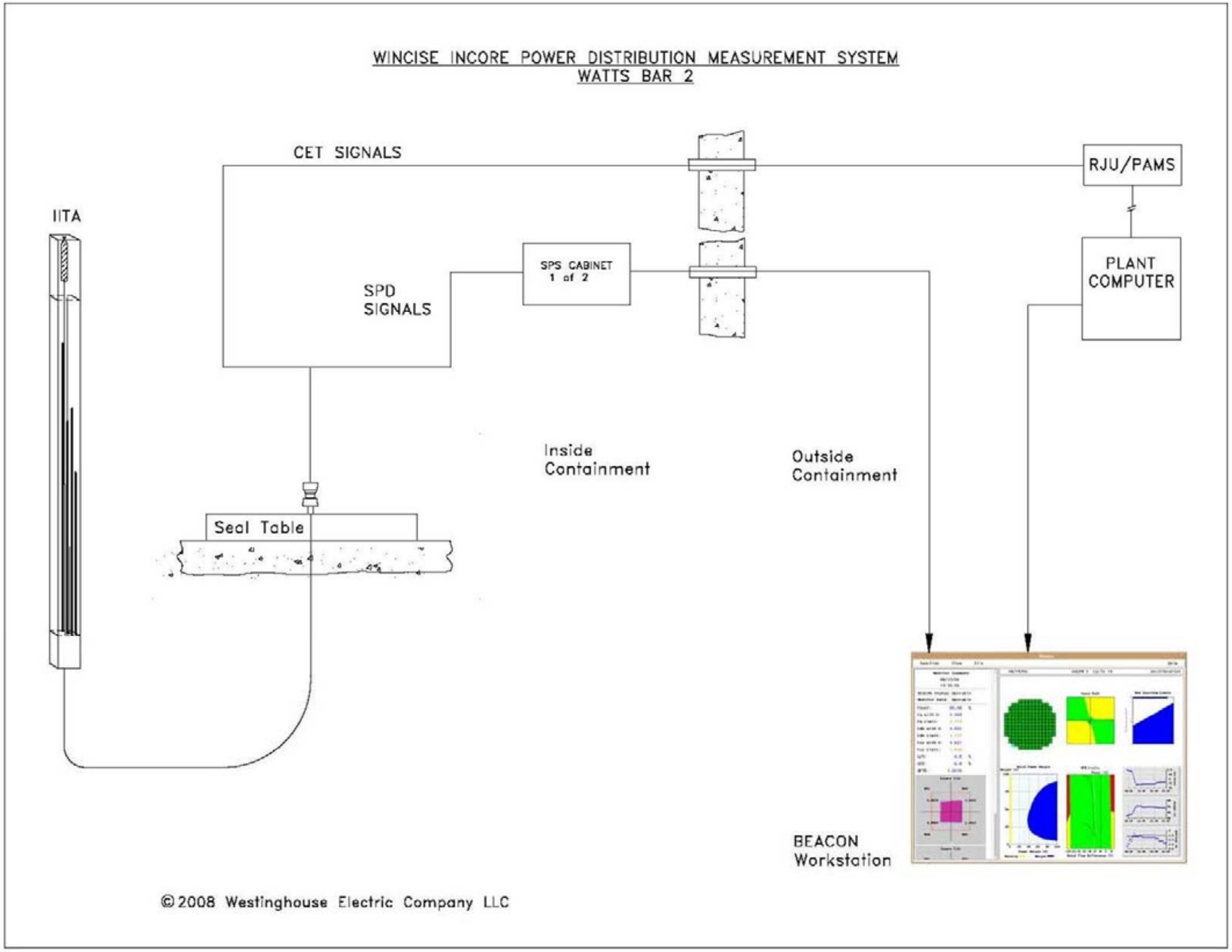
- Fixed Incore Instrumentation
  - MCR controls and recorders not required
  - Computers and hardware automate data collection
- 58 Incore Instrument Thimble Assemblies (IITAs)
  - Each has 5 Vanadium Self Powered Detectors (SPD)
  - Each has 1 Type-K CET
  - 29 Rack A and 29 Rack B

WINCISE

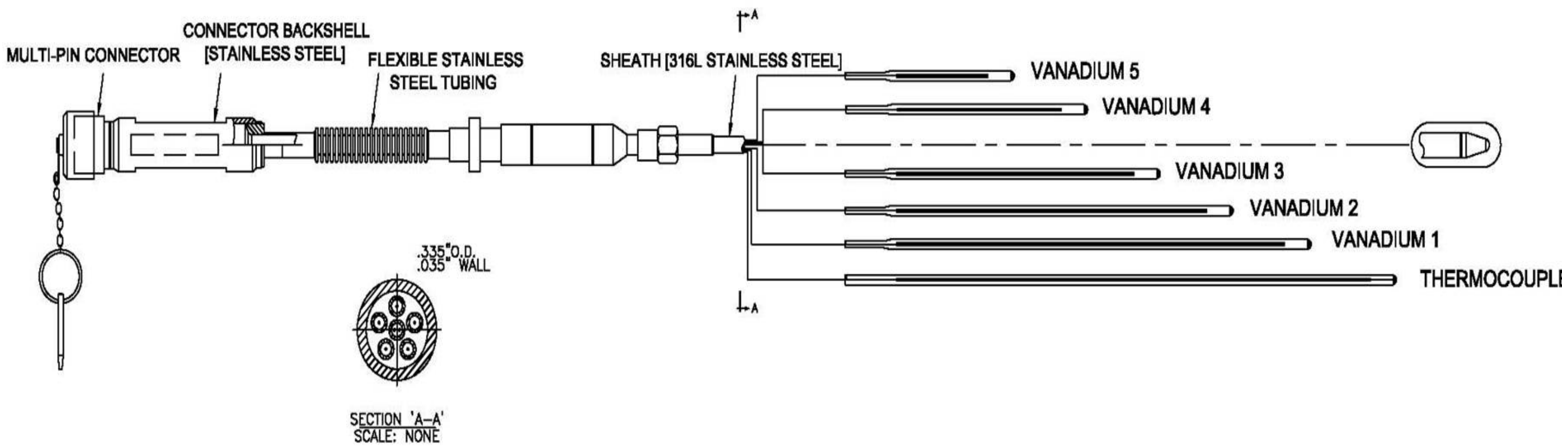
Watts Bar Unit 2 (continued)

- 2 Signal Processing System (SPS) cabinets
  - Analog-to-Digital Conversation
- Monitoring and calculating computer hardware outside containment
- CETs
  - Reference Junction Box outside of containment
  - CET columns removed
  - Eliminates reactor vessel head radiation exposure during outage

WINCISE


WINCISE INCORE POWER DISTRIBUTION MEASUREMENT SYSTEM
WATTS BAR 2
CET SIGNALS
RJU/PAMS
IITA
SPS CABINET
1 of 2
SPD
SIGNALS
PLANT
COMPUTER
Inside
Containment
Outside
Containment
Seal Table
BEACON
Workstation
© 2008 Westinghouse Electric Company LLC

WINCISE – IITA/OPARSSEL Detectors



OPARSSEL SELF-POWERED DETECTOR ASSEMBLY
FIVE [5] SEQUENTIALLY INCREASING LENGTH VANADIUM ELEMENTS
ONE [1] CORE EXIT THERMOCOUPLE