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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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SUBCOMMITTEE ON ESBWR

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OPEN SESSION

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TUESDAY

AUGUST 17, 2010

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ROCKVILLE, MARYLAND

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The Subcommittee convened at the Nuclear Regulatory Commission, Two White Flint North, Room T2B1, 11545 Rockville Pike, at 8:30 a.m., Dr. Michael Corradini, Chairman, presiding.

SUBCOMMITTEE MEMBERS PRESENT:

MICHAEL CORRADINI, Chair

SAID ABDEL-KHALIK

J. SAM ARMIJO

MICHAEL T. RYAN

JOHN W. STETKAR

CONSULTANTS TO THE SUBCOMMITTEE PRESENT:

THOMAS S. KRESS

GRAHAM B. WALLIS

NRC STAFF PRESENT:

CHRISTOPHER BROWN, Cognizant Staff Engineer

AMY CUBBAGE

ROBERT DAVIS

AMAR PAL

DAVID MISENHIMER

GEORGE CICOTTE

BRAD HARVEY

SAMIR CHAKRAHARTI

CHARLES HINSON

LESLIE PERKINS

DEVENDER REDDY

FRANK TALBOT

CRAIG HARBUCK

ALSO PRESENT:

DAVID HAMON

ERIK KIRSTEIN

WAYNE MARQUINO

ANTONIO BARRETT (via telephone)

GARY ANTHONY

MIKE ARCARO (via telephone)

SUJIT NIOGI (via telephone)

JOHN McLAMB (via telephone)

PATRICIA CAMPBELL

JOHN STRAYHAL (via telephone)

JOHN GELS (via telephone)

SARA ANDERSEN

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

8:27 a.m.

CHAIR CORRADINI: Have the meeting come to order. Let me welcome everybody back. This is a subcommittee meeting of the Advisory Committee on Reactor Safeguards, ESBWR Subcommittee Meeting. My name is Mike Corradini, Chair of the Committee.

Just to remind everybody, I'm not going to go through the normal introduction. I just want to cut to a couple of things. We have two members that have joined us from yesterday, Dr. Armijo and Dr. Ryan. We have General Electric, GEH folks on the bridge line. We are going through the second group of chapters relative to final SERs from the staff on the ESBWR design.

Let me just remind everybody that a transcript is being kept of the meeting and will be available as stated in the Federal Register notice. Speakers should first identify themselves and speak with sufficient clarity and volume so they can be readily heard.

Also, please make sure you've silenced all your cell phones and BlackBerrys and other things that go bump in the night. We've not received a

request from any members of the public to make oral statements or written comments.

At this point I'll turn to Amy Cubbage again as the lead team leader for ESBWR to kind of give us a plan of the day.

MS. CUBBAGE: Great. Good morning. So we have a number of chapters we are going to cover today. For each of these chapters we've selected some key open items that we would like to dig a little deeper into to give you an example of the scope of review.

We don't plan to go through the closure of every open item that was discussed in the NRC with open items. We're going to start with Chapter 2 this morning. Over the course of the day we're going to try to get back to the setup committee on a few questions that remain from yesterday.

One having to do with the decay heat removal for the spent fuel thermal-hydraulic analysis. Then there was another issue with the dose for, I believe, the main steam line. We'll get to that when we have an opportunity.

I would like to start the day off with GE Hitachi with their Chapter 2 presentation.

CHAIR CORRADINI: And then just to alert everybody, we will have a closed part of the session

for Chapter 18 Human Factors. Other than that, as we have it planned at least, everything else is open today.

Dave, are you going to lead us off or is Erik?

MR. HAMON: I'll start it and then Erik will pick part of it up.

CHAIR CORRADINI: Okay.

MR. HAMON: The topics cover a little bit of both our areas here so we can switch back and forth.

CHAIR CORRADINI: Okay.

MR. HAMON: I'm Dave Hamon from GE Hitachi and I've got Erik Kirstein from GE Hitachi here also with me. We're going to talk about some of the key areas of Chapter 2 to update you on progress. This is one of the last meetings on this area.

Back in 2008 we had a SER with open items from the NRC on Chapter 2. It identified four open items at that point. Item 2.3-4 related to Probable Maximum Winter Precipitation. Items 2.3-8, 2.3-9 and 2.3-10 were related to some of the boundary and parameters for the radiological analysis, a generics area.

Since that time there was one other

technical topic that came up on Chapter 2 related to ambient temperature conditions that are used for Control Room Habitability Area PF analysis and we'll tell you a little bit about that.

Open Item 2.3-4, the first part here just quotes from the SER with open items that "The applicant should also provide an additional roof design 48-hour Probable Maximum Winter Precipitation standard plant site design parameter to account for additional weight..."

What we did in response to that is we went back through and updated out tables to account for this and we have now provided parameters for maximum ground snow load under normal winter precipitation event conditions and also for an extreme winter precipitation event.

The changes we made here are consistent with interim staff guidance that was provided in COL/DC-ISG-7. With the changes we have made to the DCD we now have provided maximum ground snow loads for normal winter precipitation that we believe bound a number of sites that may be considered for COL application.

CONSULTANT WALLIS: How long does this frozen material stay on the roof?

MR. HAMON: It was for a 48-hour period.

CONSULTANT WALLIS: But if it's in Minnesota it's probably there all winter and the snow keeps on building up.

MR. HAMON: That's probably true. We were mainly focusing on the areas that were currently looking at COL applications. The intent of Chapter 2 is to provide what expect to be bounding for most potential sites. If somebody in Minnesota decided to build a plant, they would have to compare their values against --

CONSULTANT WALLIS: Montecello?

CHAIR CORRADINI: Just to remind everybody, what is the precipitation snow load in some sort of measure? I've forgotten.

MR. HAMON: Sujit, are you on?

CHAIR CORRADINI: Is anybody on. Somebody unmute yourself in Wilmington.

PARTICIPANT: Dave, we're going to go get Sujit right now.

CHAIR CORRADINI: Okay, fine. We'll come back to it.

MR. HAMON: I don't remember the exact number.

CHAIR CORRADINI: That's fine. We'll come

back to it. Just keep on going.

CONSULTANT WALLIS: But 24 hours is really a funny thing for the winter in the north.

CHAIR CORRADINI: Well, it depends what the number is.

CONSULTANT WALLIS: It's not very big but, anyway, let's go on.

MR. HAMON: Really the intent of this table is to say these are what we designed the plant for.

CONSULTANT WALLIS: Otherwise they will do something special.

MR. HAMON: If your site-specific value doesn't wall in this, it means we have to go back and relook at the building design and possibly adjust it accordingly.

CHAIR CORRADINI: Okay.

MR. HAMON: It doesn't have to bound absolutely everyone. There is a COL action to check that as part of the process.

CHAIR CORRADINI: Okay.

MR. KIRSTEIN: Good morning. I'm Erik Kirstein and I'll talk about open items 2.3-9 and 2.3-10. 2.3-9 a lot of text here. In a nutshell the discussion has to deal with the main plant stack

talking about not part of the standard design and going on asking questions on the EAB of the exclusionary boundary and the Low Population Zone (LPZ) chi/Q which are the atmospheric aspersion parameters the characteristics being less than or equal to the standard plant design parameters.

You can go to the next slide, please. So essentially what occurred, I believe, as of DCD Rev. 5, the GEH removed the reference to the main plant stack which had only one associated long-term dispersion estimate. We added three ventilation stacks to the standard design, one for the reactor building, one for the turbine building, and one for the radwaste building.

As sort of a supplement there are several supplements to RAI 2.3-9 which dealt with -- loosely had to deal with the ventilation stacks but more along the lines of the releases during an accident from various locations and the chi/Q, the on-site chi/Q values to the control room occupants.

In Rev. 5 we added Appendix 2A to Chapter 2. What Appendix 2A does is it provides COL applicants the parameters for the computer code ARCON96 which is the computer code used to calculate the short-term accident chi/Q values to the control

room operators. That was provided in Appendix 2A for the applicants to use in calculating their own control room chi/Q values.

CONSULTANT KRESS: You have three different stacks in three different parts of the plant?

MR. KIRSTEIN: It's one stack for -- the stacks are more important for, and I'll touch it on the next open item, but actually they are more relevant to the long-term dispersion estimates for normal operational release from the plant to off-site people.

CONSULTANT KRESS: So you don't take those into account in your Severe Accident?

MR. KIRSTEIN: No. I don't think any of the release points are actually from those particular stacks. Mainly the release points are from let's say, for example, the turbine building truck doors. That could be a leakage point for the control room operator or occupants during an accident.

It's kind of a mixed bag here in this particular open item because there were some supplements that kind of went back and forth between long-term and short-term dispersion estimates. The stacks in particular, like I said I'll talk about in

the next open item, those are more relevant to the long-term dispersion estimates.

CONSULTANT WALLIS: Are these lower stacks than the previous main stack?

MR. KIRSTEIN: Yes. The turbine building stack is, I think, the tallest one of the three and it's about, I believe, 72 meters above ground.

CONSULTANT WALLIS: The strategy is to have as tall a stack as possible --

MR. KIRSTEIN: That's correct.

CONSULTANT WALLIS: -- to get the stuff up there.

MR. KIRSTEIN: That's correct.

CONSULTANT WALLIS: If you replace one tall stack with three short stacks, that seems as if it could be worse unless you're just going to assume it's all on the ground anyway.

MR. MARQUINO: This is Wayne Marquino at GEH. We had a site that had a stack height limitation or a structure height limitation on the site and our standard design envelopes that site so that was one of the considerations.

MR. KIRSTEIN: The 71 meters was as tall as we could go at that time.

CONSULTANT WALLIS: But some licensees

might like to have a tall stack they can do that?

MR. KIRSTEIN: They would be able to do that.

Okay. Going on, we also indicated in the open item, or in the RAI responses, that there is a COL item 2.0-1-A which requires sort of a generic item dealing with most of the Chapter 2 parameters requiring an applicant to demonstrate that the characteristics for their given site are within the DCD parameters.

Conclusion. It's essentially just what I had talked about in the previous slide. The three ventilation stacks were added to the standard plant design. We added Appendix 2A to sort of clarify the issues in this RAI dealing with the short-term, the control room chi/Q calculational inputs for an applicant. Then we went ahead and referenced that particular COL item.

All right, 2.3-10 which deals more with the long-term dispersion estimates. Once again, there's some reference values and this is back when we had a single stack design so we had a single long-term chi/Q value for the atmospheric dispersion and a D/Q value which is the deposition parameter associated with long-term Appendix I type calculations.

As a follow-on there were several supplements to RAI 2.3-10 which also included RAI 12.2-28 since the long-term dispersion estimates actually are inputs to the Chapter 12 10 CFR 50 Appendix I dose calculations so the two are very tightly related. The RAI supplement stated that the long-term chi/Q and D/Q, which are the deposition values, may not bound a reasonable number of COL applicant sites.

So in response and in resolution to this particular open item when GEH added the three particular stacks to the three buildings we added Appendix 2B to the DCD. Appendix 2B provides the release pathway information to use for the computer code which is XOQDOQ and that's the computer code used to calculate the long-term dispersion aspects from a release point to downstream locations or receptors. Appendix 2B provides the parameters needed for use by applicants in generating their own site-specific annual average which are the long-term chi/Q and D/Q values.

CONSULTANT WALLIS: So you no longer give a specific kind of a Q value?

MR. KIRSTEIN: What we did is in the DCD those are very specific for any particular site so we

did the analysis in the DCD assuming particular chi/Q and D/Q values, assumed some receptor locations and performed the calculations for ourselves.

The purpose of Appendix 2B is when an applicant comes in the applicant can use those parameters which are like the flow rates out the stack, the stack heights, the locations, the difference between the stack height and the grade level and a couple other parameters.

Using those inputs the applicant can use the code and then determine those particular values for its particular site. Then we're on the Appendix I dose calculation to demonstrate that they meet the criteria.

2B-1 essentially what I said that these ventilation stack parameters are provided. The concern was the staff, and they might talk to it a little bit in their presentation, but the staff had a concern, and this was indicated in RAI 12.2-28, the chi/Q and D/Qs that we have in the DCD when we ran it for our particular just generic analysis might not necessarily bound some chi/Q and D/Q values and some early site permits and COL applications.

What GEH did is took several plant sites, I believe it was three, using the ESBW stack design,

the three stack configuration, and ran the numbers to demonstrate that the dose criteria are met. The reason being one can't merely just look at -- let me step back.

For the short-term accident chi/Q values if a site comes in and its short-term chi/Q value, as in the Chapter 15 case, are bounded by what's in the DCD the accident dose consequence evaluation for what the acceptance criteria would be.

For the long-term calculation, the Appendix I dose calculation, it's not necessarily a direct correlation because there are other parameters that need to be considered on a site-specific basis. What GEH did to demonstrate the fact that this is adequate for potential applicant sites is we went ahead and took the data, took the particular plant site meteorological data and ran the numbers using XOQDOQ for those particular sites and demonstrated that the Part 50 Appendix I dose criteria were met.

CONSULTANT KRESS: With three stacks.

MR. KIRSTEIN: Yes.

CONSULTANT KRESS: You had to add three chi/Qs together?

MR. KIRSTEIN: There is actually a summation because you have releases during normal

operations from various locations of the site so, yes, that's correct. For one particular release there is a certain lease for that stack, it's own chi/Q, and we calculate the dose at that particular receptor and you add them up from the three stacks.

In conclusion essentially what I said before. The concern was addressed. We added Appendix 2B to provide the applicant the parameters it would need for calculating its own long-term dispersion estimates. Then to address RAI 12.2-28 we went ahead and demonstrated that the stack design would held doses for applicants within the Appendix I criteria.

MR. HAMON: Okay. The other issue that came up after the previous SER with open items was issued was related to Control Room Habitability Area, heat-up analysis parameters. We were basically asked to provide additional ambient design temperature site parameters to support that analysis and put them in DCD.

We ended up revising DCD Tier 2 Table 2.0-1 to include three additional parameters. The maximum average dry bulb temperature for 0 percent exceedance on a maximum temperature day with a value of 39.7 degrees celsius or 103.5 fahrenheit, a minimum average dry bulb temperature for 0 percent exceedance on a

minimum temperature day of -32.5 degrees celsius or -26.5 fahrenheit, and a maximum high humidity average wet bulb globe temperature index for 0 percent exceedance on the maximum wet bulb temperature day and that value is 30.3 degrees C or 86.6 degrees F.

CONSULTANT WALLIS: These are based on historic temperatures?

MR. HAMON: Yes, I believe so.

CONSULTANT WALLIS: Well, then, the maximum temperatures for this year you might find you've got a different value.

MR. HAMON: Unless you're in California. We're having a very cool summer in California right now.

MEMBER STETKAR: Dave.

MR. HAMON: Yes.

MEMBER STETKAR: A few questions on this. You say you revised the table. I'm assuming that means you revised it in DCD Revision 8 because it certainly is not revised in DCD Revision 7. It's the only one we've seen.

MR. HAMON: In Revision 7 there were a couple supplements to this RAI. We put some parameters in 7. The staff --

MEMBER STETKAR: The parameters in 7 are

the parameters you discussed -- we had a separate meeting -- when was it, Mike, June --

CHAIR CORRADINI: Yes.

MEMBER STETKAR: -- on control room and the analyses you described in that meeting were consistent with the temperatures that were listed in Revision 7 of the DCD.

MR. HAMON: Yes. In Revision 8 the parameters that were added in Revision 7 are being replaced with ease in Revision 8.

MEMBER STETKAR: The analyses will then follow suit.

CHAIR CORRADINI: Now, the --

MEMBER STETKAR: Let me get -- I want to make the point that we haven't seen this.

CHAIR CORRADINI: Okay.

MEMBER STETKAR: We the ACRS haven't seen any analyses necessarily that use this, unless maybe we have and that's because I'm not --

MS. CUBBAGE: I was multi-tasking but what I'm going to tell you is that everything that you heard on control room temperature is consistent with this. This was all done hand in hand.

MEMBER STETKAR: I want to see if I can understand then what these mean. There's three

temperatures here and the first -- I'm not going to try to repeat the long phraseology because I know I'll screw up the words.

The first temperature that's 103.5 degrees Fahrenheit is the average temperature that's derived from a maximum dry bulb temperature of 117 degrees Fahrenheit with a diurnal swing of 22 degrees. That's the way this is derived. Those two parameters are the parameters that, indeed, were quoted in the analyses that we saw.

The question I have in terms of room heat-up is that assuming a constant average temperature of this, does that give you different results than saying I have a diurnal swing from 117 degrees down to 90 degrees over the period of 72 hours?

I don't know enough about room heat-up, heat transfer. I'm only pointing out that this implies that the analysis is done assuming a constant average temperature where the analysis that we saw, indeed, purportedly allowed the temperature to swing.

MR. MARQUINO: This is Wayne Marquino, GEH. I don't know if Antonio Barrett is on the phone now but the analysis does have diurnal swing in it daily. As you said, the peak temperature is an important parameter and the average value over the

diurnal swing is an important parameter. These three values are basically capturing the importance of average temperature in the control room heat-up or cool down.

MS. CUBBAGE: Yes, I can speak to this as well, John. This is Amy Cubbage. Basically this was changed at the request of the staff because we had concerns with the ability for a COL applicant to compare against a temperature and diurnal swing because if you had two separate site parameters, one for the temperature, one for the swing, you could have a site that has a maximum high temperature of 105 and then doesn't make the diurnal swing but their analysis would still be acceptable.

The information is being presented today as a surrogate for us to insure that the site would be suitable. We had GE do alternate calculations to demonstrate that with these temperatures you would still get acceptable results. We can discuss this a little further when the staff's presenting.

MEMBER STETKAR: Okay. Let's do that. Let me see if I can understand. I understand how the first two alluded temperatures are calculated based on what I knew before.

I can't figure out what the third bulleted

temperature means and how it's calculated because that third temperature -- in Revision 7 of the DCD and in the analyses that we saw in whatever it was, June or July, there was a zero percent exceedance maximum wet bulb mean coincident temperature of 80 degrees Fahrenheit, a zero percent exceedance maximum wet bulb non-coincident temperature of 88 degrees Fahrenheit, and a high-humidity diurnal swing of 8 degrees Fahrenheit.

This was the analysis, I believe, that the staff precipitated this analysis to look at potential sites, for example, in the Southeast U.S. where the maximum temperature wouldn't be as high as the dry climate in the west where you see 117 with a large diurnal swing but that you would see a very high humidity rather constant temperature.

Having been in hot springs Arkansas for the last two weeks I will tell you that this is true. It happens. I can't figure out -- could you explain to me how the 86.6 degrees Fahrenheit, or the 30.3 degrees celsius, is derived from those temperature parameters because I couldn't figure it out.

MR. MARQUINO: Yes. We would like to open the bridge line. We have Antonio Barrett available to answer detailed questions on this.

Antonio, are you there?

MR. BARRETT: This is Antonio Barrett from GEH. So what we did was you need to calculate what the wet bulb globe temperature index value is which is a combination of the wet bulb temperature and the dry bulb temperature. It's .7 times the dry bulb temperature but .3 times the wet bulb temperature.

That's how you get a wet bulb globe temperature index. What we did was is that based off of a wet bulb temperature of 88 degrees Fahrenheit we would then determine what the coincident dry bulb temperature is and then we looked at plus or minus three days for the worst conditions and then we then determined what the wet bulb globe temperature was for that, the average wet bulb globe temperature for that period.

An applicant would then have to determine what theirs is based off of their worst wet bulb temperature coincident with its dry bulb temperature and then calculate its average wet bulb globe temperature index based off of the equation. For this parameters that we list in the DCD we provided a note that points to a different section of the DCD that spells out exactly how to calculate their values.

MEMBER STETKAR: I was really curious

about that because it's apparently in Revision 8 of the DCD which, as I mentioned, we haven't seen.

MS. CUBBAGE: I will forward you the DCD markups. They were provided in response to RAI 6.4-24 Supplement 2.

CHAIR CORRADINI: You will provide that to us?

MS. CUBBAGE: Right now, yes.

MEMBER STETKAR: Okay. I thought I remembered seeing that equation somewhere.

CHAIR CORRADINI: We saw it in the presentation. We did not see it written down. When Tony was here physically we went over this in detail.

Is that correct, Antonio?

MR. BARRETT: That's correct.

MEMBER STETKAR: All right. Thanks.

MR. MARQUINO: And we haven't changed the analysis. We are using the standard definition of wet bulb globe temperature. What we clarified with the staff in the last round is the site confirmation step to make it very crisp.

MEMBER STETKAR: Okay. Thanks. As long as I understand how the temperature was derived I'm pretty happy. Thanks.

CHAIR CORRADINI: Right.

MR. HAMON: As Antonio said, as part of the notes that go with Table 2.0-1 there is a reference, I believe, to Appendix 3H that has additional information on how to calculate this.

MEMBER STETKAR: Yes, but the problem is we only have Revision 7 of the DCD and this is all new.

MR. HAMON: I understand. Okay.

So, in summary at this point, all issues from the SER with open items in 2008 have been addressed and DCD Tier 2 Chapter 2. We have no open RAIs remaining at this time.

Any other questions?

CHAIR CORRADINI: John.

MEMBER STETKAR: One question. I honestly don't know whether this change -- in fact, I know that these values haven't changed since DCD Revision 4. I just never asked about it before. In Table 2.0-1 you list values for maximum groundwater level elevation and maximum flood level. Maximum groundwater elevation is -- I use English units -- two feet below plant grade. Maximum flood level is one foot below plant grade. Why are they different?

MR. HAMON: We actually took those directly out of the URD.

MEMBER STETKAR: I checked a few other applications and they all seem to use consistent elevations,.

MR. HAMON: If you actually pull up the EPRI URD and look up the table at the beginning of it you will see the same two values. That's where we picked those up originally. Those have been in there since DCD Rev. 0, I believe.

MEMBER STETKAR: I only had back to Rev. 4. As I said, I have to apologize I didn't ask about them earlier.

MR. HAMON: I think even the ABWR certification used the same numbers.

MEMBER STETKAR: Is there any safety-related equipment located more than -- I'll pick two feet -- more than two feet below grade?

MR. ANTHONY: Gary Anthony speaking here. Yes, they are all in flood-protected buildings.

MEMBER STETKAR: Make sure you state your name.

CHAIR CORRADINI: You have to state your name.

MR. ANTHONY: I did. Gary Anthony speaking. Safety-related equipment are in flood-protected buildings as per Chapter 3 calls out.

Basically you have RHR systems that are below grade ad fuel pool systems that are below grade.

MR. HAMON: But those aren't safety related. The PCCS and the ICS are way up high and GDCS was fairly high. I believe that's probably above grade also.

CHAIR CORRADINI: So, John, your worry is --

MEMBER STETKAR: My main concern is since the groundwater elevation is allowed to be -- floods are different. They are more transitory. You can protect exterior of buildings from flood barriers and diversions and things like that. Groundwater is a little bit more difficult to protect against so I'll focus on the groundwater.

If the maximum groundwater elevation is only two feet below plant grade, that means whatever is more than two feet below plant grade is potentially below groundwater level. If there is safety-related equipment in those buildings do you have any special design features for dewatering or things like that? How do you prevent groundwater intrusion?

CHAIR CORRADINI: I'm not sure if you were on -- I know we talked about this at length but I don't remember what year it was. I do think when we

did talk about Chapter 2, but I don't know when, and I want GE to clarify -- I don't know if it's you guys or that group -- it's an option. Dewatering is an option in the design but not a requirement in the base design. That's my memory of when we last talked about this.

MR. HAMON: I believe --Sujit? Have you found Sujit yet?

MEMBER STETKAR: That could be because I did come in after you were rolling to some extent.l

CHAIR CORRADINI: If we your folks are not on the line, at least we should clarify later to be where we are on this because that's my memory.

MEMBER STETKAR: If you recall that, that's fine. I noticed as a curiosity that the two levels were different but I was mostly looking for the groundwater issue.

MR. HAMON: Like I say, I don't know why they were different to begin with. It's something we picked up from the URD and I would have to go look into their basis to see why they did that.

MR. ARCARO: This is Mike Arcaro of GEH. The previous statement out of the DCD it talks about equipment necessary for safe shutdown is located above the maximum flood level for that location or is

qualified for flood conditions.

MEMBER STETKAR: That's not what he's talking about.

MR. ARCARO: So design puts water-right floors in the lower elevations.

MEMBER STETKAR: Again, flood and flood is a little bit different hydraulicly than groundwater.

CHAIR CORRADINI: I couldn't hear who just spoke in Wilmington but I'm pretty sure when we first discussed Chapter 2 we were worried about normal groundwater versus flood conditions and the closeness of those levels. Again, I'll check myself but I seem to remember the base design does not require a dewatering system. It's an optional part of the design as I remember it.

MR. NIOGI: This is Sujit.

CHAIR CORRADINI: Okay. Good.

MR. NIOGI: We do not have that dewatering system. The dewatering system we have is during construction. Also groundwater level of two feet is in the design and what we did we make sure based on penetration below that level that no water can enter into the building.

CHAIR CORRADINI: So can I repeat what you just said? So there's no dewatering system as the

base part of the design.

MR. NIOGI: Yes.

CHAIR CORRADINI: And there's no penetrations below the groundwater level in the design.

MR. NIOGI: If we have any penetration below we seal so that no water can enter into the building.

CHAIR CORRADINI: I didn't understand that last part. You said there's no penetrations. Then, again, can you repeat your last part? I'm sorry.

MR. NIOGI: If we have any penetration which we look at it below the groundwater level and the design is such a way that the water cannot penetrate into the building.

CHAIR CORRADINI: Okay. But there is no dewatering system as part of the base design?

MR. NIOGI: There is no dewatering system as part of the base design.

CHAIR CORRADINI: Let me just ask one other question. I seem to remember when we discussed this a few years ago there was, though, optional -- there was a part of the design optionally that a dewatering system could be installed. Is that correct?

MR. NIOGI: There is a provision for a dewatering system and during construction we can use that but it's not designed to be as a permanent plan design feature.

CHAIR CORRADINI: Okay. All right. Let's move on. I want to check back to my notes. Thank you.

MR. NIOGI: You're welcome.

MR. MARQUINO: Mr. Hamon has an answer to your question about the MSIV leakage from yesterday if you want to cover it while he's up there.

MEMBER STETKAR: Sure, yes.

MR. HAMON: It's relatively short. I went back and looked at that RAI response yesterday. The reason we didn't include the MSIV leakage path in the TMI Item 3D.11 surveillance program is that issue was primarily focused on doing leakage checks on systems that aren't normally active when the plant is running and, thus, aren't being checked on a continuous basis. The piping and stuff associated with that MSIV leakage path is active during normal plant operation. It's continuously monitored and if there were any leaks, we would pick them up during normal operation and take actions to fix them.

MEMBER STETKAR: What were the four

systems that were in scope? I don't have it right in front of me.

MR. HAMON: It's the isolation condenser system. It's the FAPCS, the Fuel and Auxiliary Pools Cooling System; the continued monitoring system because we have penetrations for doing hydrogen and oxygen concentration and containment. Then we added the RWCU system to it due to a design change that would let us use it for residual heat removal.

MEMBER STETKAR: But RWCU, FAPCS, and at least part of the isolation condensers, at least the steam supply side of the isolation condensers are normally in service during normal power operation. Aren't they?

MR. HAMON: The stem supply lines are open. The return lines are not open but it's also submerged under water.

MEMBER STETKAR: I'll give you that one but FAPCS is normally running as is main steam,. RWCU is also.

MR. HAMON: FAPCS you want to remember when you need to for cooling.

MEMBER STETKAR: It will be running.

MR. HAMON: It will be running but not necessarily the whole flow path that we would be using

for suppression pool after a LOCA. Some parts of it may be covered during normal operation.

MEMBER STETKAR: But the justification is that basically because main steam is normally running you would --

MR. HAMON: You'd be monitoring it and checking for leakage and any high radiation readings during normal operation so it didn't need a special program.

MEMBER STETKAR: Okay. Thanks.

MR. HAMON: Okay.

CHAIR CORRADINI: Okay. Other questions for Erik or Dave? Okay. So we'll have staff.

MR. McLAMB: This is John McLamb GEH in Wilmington. If we could, real quick, we've got an answer to Dr. Wallis' question about the maximum snow loading.

CHAIR CORRADINI: Great.

MR. McLAMB: Sujit Niogi would like to provide that for you.

CHAIR CORRADINI: Go ahead.

MR. McLAMB: The question was what was the maximum assumed snow loading for buildings in the ESBWR.

MR. NIOGI: The maximum number snow load

we have considered in the design is 50 pounds per square foot. This is for the ground. And also maximum ground snow load for extreme winter precipitation we have considered 162 pounds per square foot.

CONSULTANT WALLIS: That's in the staff's presentation anyway. Thank you very much.

CHAIR CORRADINI: Thank you very much.

Okay. We'll switch over. Dave is going to leave the group, I assume.

MR. HAMON: Yes.

MR. MISENHIMER: My name is Dave Misenhimer. I'm the chapter PM for Chapter 2. Today we are going to have Brad Harvey address some significant RAIs.

MEMBER RYAN: Dave, you might want to move that microphone to your left. Thank you.

MR. MISENHIMER: I'll let Brad take it from here.

MR. HARVEY: Hello. My name is Brad Harvey. I'm a meteorologist in the Siting and Accident Consequence Branch within the division of Site Environmental Reviews. I'll be discussing staff's review of the ESBWR DCD Tier 2 Chapter 2 site characteristics with an emphasis on SER Section 2.3

numerology.

I'll be concentrating my discussion on the resolution of several open items that were tracked in the SER with open items. In particular I would like to discuss resolution of open items related to:

(1) Ground snow load site parameters that are used to determine normal and extreme winter precipitation roof loads.

(2) Identification of release pathways and receptor locations for determining control room atmospheric dispersion factor or chi/Q values.

(3) The assumptions used by the applicant to derived its long-term dispersion chi/Q and atmospheric deposition or D/Q values.

I will also be discussing two technical topics of interest that have arisen during previous ACRS meetings.

(1) The addition of three new design temperature site parameters to support the control room habitability area heat-up analysis that was discussed during the May 8 ACRS meeting.

(2) The comparison of loading design criteria between seismic Category 1 and 2 structures, and RTNSS, a regulatory treatment and non-safety

system structures which is a topic that came up during the June ACRS meeting on SER Chapter 22.

Ground snow load. The applicant initially chose winter precipitation roof design site parameters which consisted of a 100-year maximum ground snow load value at 50 pounds per square foot and a maximum 48-hour winter rain fall value of 36 inches.

The applicant stated its maximum 48-hour winter rain fall site parameter value of 36 inches would result in an additional rate of only four inches of water on the roof because the lower lip of the roof scuppers is only four inches above the roof.

The staff issued an open item because the staff believed the applicant should also provide an additional roof design parameter that assumes that at least part of the maximum 48-hour winter rain fall falls as frozen precipitation such as snow and/or ice and, therefore, remains on the roof.

The staff subsequently issued interim staff guidance document ISG-7 to clarify staff's position on identifying winter precipitation events as site characteristics and site parameters for determining normal and extreme winter precipitation loads on the roofs of seismic Category 1 structure.

ISG-7 specifies two roof loads, a normal

winter precipitation roof load and extreme winter precipitation roof load is a function of the highest ground level weight of 100-year return snow pack or historic maximum snow pack.

CONSULTANT WALLIS: Can I comment on this now? This is based on the average snow depth on the ground.

MR. HARVEY: Correct.

CONSULTANT WALLIS: When you have a storm on the roof the snow drifts on the leeward side so you might have two feet of snow falling meterologically but you might have four feet of snow on the backside of your roof because it deposits all on the backside of the roof so the snow load on the roof isn't necessarily the same as the snow load on the ground.

MR. HARVEY: That's correct.

CONSULTANT WALLIS: Is that taken under consideration?

MR. HARVEY: I believe that is addressed in Chapter 3 of the DCD. I believe, and the applicant can correct me if I'm wrong, ASCE, which is the --

CONSULTANT WALLIS: Civil Engineering Guide?

MR. HARVEY: Yes, Civil Engineering Guide has a section. I think Chapter discussed it.

CONSULTANT WALLIS: That's taken into account?

MR. HARVEY: I believe it is.

CONSULTANT WALLIS: You believe it is?

MR. HARVEY: I believe it is. That's not part of -- I'll have a staff member in Chapter 3 who can discuss that. It's not part of my responsibilities.

MR. CHAKRAHARTI: I'm Samir Chakraharti. I'm the reviewer for Section 3.8. In ISG-7 also we have --

CHAIR CORRADINI: Start over slowly.

MR. CHAKRAHARTI: This is Samir Chakraharti. I'm the reviewer for Section 3.8 of the ESBWR DCD. In the IGS-7 we have specified that when roof snow load is considered the drift also should be accounted for. ASCE has guidance how this drift is considered depending on the configuration of the roof and adjacent buildings. That's part of the design consideration.

CONSULTANT WALLIS: Thank you.

MR. HARVEY: The extreme precipitation roof load is based on a normal winter precipitation roof load plus the weight of either (1) the 100-year return on historic maximum two-day snow fall event, or

(2) 48-hour probable maximum winter precipitation event.

The snow fall event is assumed to accumulate on the roof on top of the antecedent normal winter precipitation event. Whereas the 48-hour probable maximum winter precipitation event, which is assumed to fall as rain, may or may not accumulate on a roof depending on the geometry of the roof and the type of drainage provided.

CONSULTANT WALLIS: So you add the snow pack to this 24 hours?

MR. HARVEY: That's correct.

CONSULTANT WALLIS: Well, 36 inches of rain is more than 162 foot-pounds per square foot.

MR. HARVEY: You are correct. That's because the parapet is only two feet high.

CONSULTANT WALLIS: So it does run off although it's supposed to be frozen?

MR. HARVEY: The frozen is not the 36 inches of rain fall.

CONSULTANT WALLIS: It's very unlikely to get 36 inches of freezing rain.

MR. HARVEY: That's correct.

CONSULTANT WALLIS: You don't get

hurricanes in the winter. Do you still get 36 inches of rain in southern places in the winter? I guess you do.

MR. HARVEY: I think normal, yes, you can along the Gulf Coast.

CONSULTANT WALLIS: But there's not much snow down there.

MR. HARVEY: No. But the theory is if you had --

MEMBER STETKAR: Houston had snow this winter.

CONSULTANT WALLIS: It doesn't hold 36 inches of rain though?

MR. HARVEY: No. The whole idea is if you have ice or snow that clogs your drainage and then you have a significant rainfall then what happens. The response to that is the parapet is only two feet tall. In theory you're not going to have more than two feet of water at anytime on top the roof.

CONSULTANT WALLIS: Stadiums have collapsed and things.

MR. HARVEY: In response to ISG-7 the applicant eventually chose winter precipitation roof design site parameters consistent with a maximum ground snow load of 50 pounds a square foot for the

normal winter precipitation roof load, a maximum ground snow load value of 162 pounds per square feet.

CONSULTANT WALLIS: The second number matters because that's what you design it for, isn't it? You design it for the maximum.

MR. HARVEY: Well, there is the normal and then there's the extreme.

CONSULTANT WALLIS: Normal doesn't help you in the design. You better design for the maximum.

MR. HARVEY: I think there are different load combinations or load factors that are used for the normal versus the extreme situation. That's why there's --

CONSULTANT WALLIS: They are designed for the worst case.

MR. HARVEY: One of those situations will be bounding. That's correct. But you look at the normal which is --

CONSULTANT WALLIS: Extreme has to be bounding.

MR. HARVEY: What?

CONSULTANT WALLIS: Extreme must be bounding by definition.

MR. HARVEY: I'm going to ask my Chapter 3 counterpart if he could provide more insight.

MR. CHAKRAHARTI: The normal winter precipitation load we treat as normal light load on the roof with whatever factors. The extreme winter precipitation is treated as an extreme load which does not have the associated load factors with it. Yes, the extreme load, not the normal load. It's way too high.

CONSULTANT WALLIS: Thank you.

MEMBER ARMIJO: I guess I'm still trying to understand these snow load issues and precipitation issues have existed for a long time. People have designed and built plants. What's unique about the ESBWR that we are discussing this in terms of -- what's new here?

MR. HARVEY: The only thing that's new I think is to make sure our guidance is more consistent. I think it was somewhat ambivious during the current licensing of plants and so it wasn't clear to the applicants or even to our mind exactly what normal is and what extreme roof load is.

MS. CUBBAGE: And this is the first application of ISG-7. The ISG-7 came out during this review.

MR. HARVEY: As a result of our review actually.

MS. CUBBAGE: As a result of our review, yes.

MEMBER ARMIJO: So if we look back to an operating plant that didn't have to conform to ISG-7 would we wind up with snow loads of 50-foot pound per square foot for normal and 162 for extreme? Was it just bad luck for the ESBWR?

MR. HARVEY: Part of the issue is that the plants were designed for site-specific back in the old days and this is meant for much broader potential sites.

CHAIR CORRADINI: It potentially alleviates the need for site-specific but if they exceed this they would have to do a site-specific analysis and make modifications.

MEMBER ARMIJO: Okay.

CHAIR CORRADINI: Is that correct?

CONSULTANT WALLIS: So it means the roof is over designed for many parts of the country. That's the point.

MR. HARVEY: A lot of the plants are over designed for a large part of the country for that reason. If you're trying to bound a large number of sites, you can site this plant.

The staff compared the applicant's 50

pounds per square foot snow load value against snow fall data recorded at weather stations located throughout the contiguous United States and found that the applicant's site parameter values bounded most weather station sites.

The applicant's extreme winter precipitation roof load of 162 pounds per square foot is based on load accumulating up to the top of the two-foot parapet during a 48-hour probable maximum winter precipitation event which is the maximum roof load the staff would expect to occur.

CONSULTANT WALLIS: This response to this RAI would seem to be significant. This is a big change in the maximum load. Isn't it?

MR. HARVEY: Yes, but I think, and the applicant can correct me, I think the seismic design of the plant is actually --

CONSULTANT WALLIS: Covers that anyway.

MR. HARVEY: -- covers this anyway. I'm not sure that we put any additional strain on redesign for this.

CONSULTANT WALLIS: So seismic also considers shaking a roof covered with this load?

MR. HARVEY: I would say I don't know.

CONSULTANT WALLIS: I wonder if it does.

MR. CHAKRAHARTI: No. The extreme --

CHAIR CORRADINI: Would you please identify yourself?

MR. CHAKRAHARTI: This is Samir Chakraharti again. The extreme winter precipitation load has been treated as an extreme load and not in conjunction with SSE load.

MR. HARVEY: The staff, therefore, finds the applicant's revised winter precipitation for roof design site parameters to be acceptable and this open item to be closed.

Control and chi/Q values. The staff identified an open item when it reviewed the applicant's control and chi/Q values in DCD Rev. 4. The control and chi/Q values are used to help demonstrate that the radiological consequences of accidents meet dose criteria in the control room as specified in GDC-19. The staff wanted to ensure that the assumed fission product transport to the environment for each analyzed design basis accident with the chi/Q values used to monitor release pathway.

The staff asked the applicant to provide details concerning the distances and directions between each potential accident release pathway and each control room air intake and in-leakage pathway.

This information will be needed by each COL applicant in developing site-specific control and chi/Q values.

In response to this open item the applicant added Appendix 2A to Tier 2 Chapter 2 of the DCD. This appendix identifies all the potential release pathways to the environment as well as the control intake and in-leakage locations. This appendix also provides the source and receptor distances and directions to be used by COL applicants in generating site-specific control room chi/Q values for comparison with the corresponding DCD site parameter values. The addition of Appendix 2A to the DCD the staff considers this open item to be resolved.

Long-term chi/Q and D/Q values. The staff identified another open item when it reviewed the applicant's long-term chi/Q and D/Q values in DCD Revision 4. The long-term chi/Q and D/Q values are used to help demonstrate compliance with the off-site radionuclide concentration criteria at 10 CFR 20 Part 1406 and the dose criteria in Appendix I to 10 CFR Part 50.

The staff found that the applicant's long-term chi/Q and D/Q values did not bound the corresponding site characteristic values for the first

three ESP sites. The staff is, therefore, concerned that the long-term chi/Q and D/Q values may not bound a reasonable number of sites that may be considered within a COL application. Therefore, the staff asked the applicant to provide the technical basis and input assumptions it used to derive its long-term Chi/Q and D/Q site parameter values.

After several iterations including revisions and redesigns of the ventilation stacks. This open item was resolved by the applicant demonstrating that the ESBWR design yields acceptable gaseous effluent doses for three potential COL sites using the ESBWR design.

The applicant calculated site-specific chi/Q and D/Q values using site meteorological data and ESBWR ventilation stack parameters. While several chi/Q and D/Q values for these three sites were not bounded by the corresponding DCD site parameter values, the applicant nevertheless found that all three sites met the Appendix I dose criteria using the ESBWR design.

This is because DCD calculates Appendix I doses assuming all the receptors of interest such as the nearest site boundary vegetable garden, milk and meat animals are all co-located and, therefore, have

the same chi/Q and D/Q values.

In reality a COL applicant will perform its own site-specific dose analysis using chi/Q and D/Q values based on the location of its receptors of interest. These receptors of interest may be at different distances with the result that each type of receptor may have different chi/Q and D/Q values, some higher, some lower than the site-parameter values assumed for the DCD.

The purpose of certifying a standard plant design is to approve a design that can be sited at a reasonable number of sites without having to undergo a design review or change. Because the applicant has met this criterion by demonstrating that the Appendix I dose criteria can be met for three potential COL sites using the ESBWR airborne source term and site-specific chi/Q and D/Q values, the staff concludes that the DCD long-term chi/Q and D/Q site parameter values are acceptable.

Ambient design temperature site parameters. One of the technical topics I would like to discuss with you are the new set of chi parameters related to control room habitability area heat-up analysis discussed during the May ACRS meeting.

This table list the ambient design

temperature site parameters that are to be included in the ESBWR DCD. The three site parameters listed in bold at the bottom of this table are the new set of ambient design temperature site parameters related to the control room habitability area heat-up analysis.

The applicant first proposed new control room habitability site area parameters supplemental to Revision 1 response to RAI 6.4-24. The staff subsequently -- I think those are the values that you see in Rev. 7 of the DCD. The staff subsequently issued a follow-up RAI asking the applicant to clarify the methodology to be used by COL applicants in calculating chi characteristic values that correspond to these new site parameter values.

The staff also asked the applicant to provide evidence that the values assigned to each of these new site parameters envelope most potential COL sites in the United States. After a couple of iterations three new site parameter values related to the control room habitability area were established as follows:

The first one is the maximum average dry bulb temperature with 0 percent exceedance maximum temperature day with has a value, and I'm going to use the English unit if I might, 103.5 degrees Fahrenheit.

This site parameter is used to evaluate maximum temperature conditions for the control room habituality area heat-up analysis. The site parameter value of 103.5 degrees Fahrenheit was derived by considering the 0 percent exceedance maximum dry bulb temperature of 117 degrees Fahrenheit and assuming a daily temperature range of 27 degrees Fahrenheit.

These are the assumptions used in the DCD control room habitability area heat-up analysis. In our example what you have in front of you is an example from an actual weather station site in Texas. I'm using this as an example for what a COL applicant would need to do.

The corresponding site characteristic value is defined as the average of the zero percent exceedance maximum dry bulb temperature, which happens to be 110 degrees Fahrenheit in our example, and a dry bulb temperature resulting from a daily temperature range where the daily temperature range is defined as the dry bulb temperature difference between the 0 percent exceedance maximum dry bulb temperature 110 degrees Fahrenheit and the dry bulb temperature that corresponds to the higher of the daily lows before and after that maximum. We looked at the daily lows before and after the 110 degrees. There were 75 and

77 degrees.

CONSULTANT WALLIS: Averages taken is simply the mean of the maximum event.

MR. HARVEY: The mean of 110 and the 77 in our case.

CONSULTANT WALLIS: In places where the day is much longer than the night this doesn't quite make sense.

MR. HARVEY: We're looking basically 24 hours before and after.

CONSULTANT WALLIS: If you just take that average you could be off by a few degrees in terms of the effective average for a situation where the day is much longer than the night.

MR. HARVEY: The night temperature.

CONSULTANT WALLIS: In that case you might get a different number in the control room temperature.

MEMBER STETKAR: I don't do these calculations but that is my concern.

CONSULTANT WALLIS: You seem to be agreeing.

MEMBER STETKAR: It's energy in versus energy out.

CONSULTANT WALLIS: So there is an

approximation here which --

MEMBER STETKAR: It assumes sinusoidal --

CONSULTANT WALLIS: It assumes something.

MEMBER STETKAR: A pure sinusoidal variation I think.

CONSULTANT WALLIS: It seems to me they are fairly close to the limit so it might make a difference.

MR. HARVEY: This is the applicant's methodology.

CONSULTANT WALLIS: This is also the regulation.

MR. BARRETT: This is Antonio Barrett from GEH. The sinusoidal temperature swing that we used in the analysis is from the fundamentals for the day and night temperature profile so it's directly from that particular reference.

CONSULTANT WALLIS: I think probably in Alaska in the summer it's not really a very valid assumption, is it?

MR. BARRETT: It's much cooler in Alaska.

CONSULTANT WALLIS: No, I mean in terms of a sinusoidal.

MR. MARQUINO: I also want to point out

that we have committed to use of the limiting value for one day and then apply that over three days. We are not getting any credit. In this example you can see that the third day is considerably lower than the other two days. In our analysis and in comparison to the criteria we would be using that maximum middle day and applying it three times.

MEMBER STETKAR: When an applicant actually does this analysis because the COL applicant will have to verify that their site conforms to the specifications in the DCD, I guess they have to look at historical meteorological daily temperature swings over how long a period? Ten years? Fifty years?

CHAIR CORRADINI: Can I use that in jest?

MEMBER STETKAR: Look at a rolling three-day period how long? You can't look at just one year's worth of temperature data and say that captures the site.

CHAIR CORRADINI: I don't know if you reported the North Anna but my memory -- I could go back and check my notes but my memory for North Anna they had to go back 25 years.

MEMBER STETKAR: Did they?

CHAIR CORRADINI: Yes. In this case with the old data they were bounded by the old data for the

ESBWR. I seem to remember going back in time something like 20 to 25 years.

MEMBER STETKAR: Daily temperature swings 20 to 25 years. In many sites it's hard to find that level of detail.

MR. HARVEY: Well, typically what you are trying to do is find a national weather service site nearby.

CHAIR CORRADINI: A station nearby the site.

MR. HARVEY: A representative. I think typically we look at at least 30 years.

CHAIR CORRADINI: Okay.

MR. HARVEY: What we're looking for is really the way it's defined is you look at what the maximum historic temperature recorded was during that 30-year period. Hypothetically let's say it's 110. Then you look at the day before and after and figure out what the temperature swing was.

CHAIR CORRADINI: Would that necessarily give you the right average if, for example, you had one really hot day surrounded by two storm systems going through that were really cold on both days compared to --

MS. CUBBAGE: But they also have to meet

the top exceedance temperature. If you're starting at a lower temperature --

MEMBER STETKAR: Not anymore they don't. The top exceedance isn't in there anymore. Only the average is there.

MR. HARVEY: It is another site parameters.

MS. CUBBAGE: It's still there.

MR. HARVEY: It's still a site parameter. That first table I put up.

MR. BARRETT: This is Antonio Barrett from GEH. The 0 percent exceedance value is still in the table and then the average --

MEMBER STETKAR: Ah, okay.

MS. CUBBAGE: The average is the surrogate to pick up the swing.

MEMBER STETKAR: Okay. Thanks. That helps. That helps a lot because we don't have the actual table and I thought I heard words saying that these new three values would replace those parameters that were formerly listed in Table 2.0-1. The former parameters were 117, for example, with a 27 degree swing.

It was my understanding that the average was replacing those two values. What I'm hearing now

is the table contains 117 degrees and the average. Is that correct?

MR. HAMON: This is Dave Hamon from GEH. With the two values that were added in Rev. 7 are being replaced with these three new values. Everything else that was in the table previously is still the same as it was.

MR. HARVEY: -- only temperature.

MEMBER STETKAR: That is basically Table 2.0-1 on the slide?

MS. CUBBAGE: Right. You will see the 117 is still there.

MEMBER STETKAR: Great. Thanks.

MS. CUBBAGE: Sorry for that confusion.

MEMBER STETKAR: I was concerned that, indeed, both the 117 and the 27 were simply replaced by the average. As long as the 117 is still in there with the average, that will --

CHAIR CORRADINI: And the calculations we saw in June are consistent with that.

MEMBER STETKAR: Yes.

MS. CUBBAGE: So getting back to the original concern, if you have the diurnal swing as a separate 27 degree limit the COL applicants would have to be both the 117 and the swing where, in fact, they

may have a site that only has 105 temperature and then we're still forcing them to meet the 27 swing which may not be feasible.

MEMBER STETKAR: It still doesn't obviate the need, though, to go back through historical temperature records because simply searching for the hottest day over the last 30 years and looking at the 27-hour period surrounding that peak doesn't necessarily give you the maximum average three-day temperature.

MR. MARQUINO: Yes, that's true. However, it's not onerous to do a search with historical records. I did this for the global temperature. We paid less than 100 dollars to buy it over the internet and process it into Excel and it took me eight hours to get the summer months processed from the digital data which goes back about 15 years. If the requirement is -- I'm not sure what the requirement is.

MEMBER STETKAR: I don't either.

MR. MARQUINO: Twenty-five years. There are some directorates and you would do what the staff indicated to look for the high temperature periods. They are summarized in the records and you can zero in on them and process those.

MS. CUBBAGE: If I might, and Antonio can chime in and help me because our technical reviewer couldn't be here today on the temperature analysis, but it's my understanding that once you start backing away from that 117 if you're not at your hottest day, then there's not a lot of sensitivity to the swing.

MR. BARRETT: This is Antonio Barrett. That's correct. The most limiting value is the high temperature value.

MS. CUBBAGE: So if you're at a low or high temperature for that day, the analysis is not as close to the limit and you're not relying on as much swing. I'm not stating it well but --

MEMBER STETKAR: You mean the control room heat-up analysis.

MS. CUBBAGE: For the control room heat-up analysis. The 117 was really critical. On that 117 day you needed the 27-degree swing which now is derived from this average.

CHAIR CORRADINI: Okay. Let's go on.

CONSULTANT WALLIS: Does the wet bulb swing too?

MS. CUBBAGE: Yes.

MEMBER STETKAR: Let them get two more slides.

MR. HARVEY: Then we've got the fun one.

Next slide. The second control room habitability area site parameter is minimum average dry bulb temperature with zero percent exceedance minimum temperature day which is -26.5 degrees Fahrenheit. This site parameter is used to evaluate minimum temperature conditions for control room habitability area heat-up analysis.

The site plan with a value of -26.5 degrees Fahrenheit was derived by considering zero percent exceedance minimum dry bulb temperature of -40 degrees Fahrenheit and assuming a daily temperature range of 27 degrees Fahrenheit. These are the assumptions used in the DCD control room habitability area heat-up analysis.

In our example the corresponding site characteristic value is defined as the average of the zero percent exceedance minimum dry bulb temperature -- our example is -17 degrees Fahrenheit -- and a dry bulb temperature resulting from a daily temperature range where the daily temperature range is defined as the dry bulb temperature difference between the zero percent exceedance minimum dry bulb temperature -17 degrees Fahrenheit, and a dry bulb temperature that corresponds to the lower of the daily highs before and

after that minimum.

In our particular case that's 0 degrees Fahrenheit so you're taking the average of the -17 and the 0 and coming up with -8.5. That's what you would be comparing to the site parameter value of -26.5.

CONSULTANT WALLIS: There may not be a maximum temperature. I guess the maximum temperature could be one extreme. It doesn't have to be a maximum in the day so it wouldn't be on the extreme side. It depends on when you start the day. You start the day when?

MR. HARVEY: I would assume you would start the day whenever the minimum temperature had occurred.

CONSULTANT WALLIS: Suppose you just have the dry bulb going down continuously for two days, which it does sometimes, where is the maximum?

MR. HARVEY: I guess you would look at 24 hours before or after.

CONSULTANT WALLIS: Then it depends on when you start the 24 hours.

CHAIR CORRADINI: I would think they would have to look a full cycle on either side.

CONSULTANT WALLIS: You would have to decide when you start the day. I'm sure you followed

this.

MR. HARVEY: Yes.

CONSULTANT WALLIS: It's not an unequivocal definition.

MR. HARVEY: No, which is why we went through this exercise of actually looking at real data to see how we would implement this. That was the intent of putting the slides together.

CHAIR CORRADINI: Go ahead. This is the one you wanted, Graham.

CONSULTANT WALLIS: Oh, the next one?

MR. HARVEY: Okay. Here we have dry bulb and wet bulb at the same time. The third is a maximum high humidity average wet bulb globe temperature index for 0 percent exceedance and maximum wet bulb temperature day of 86.6 degrees Fahrenheit.

This site parameter is used to evaluate high humidity conditions for the control room habitability area heat-up analysis. It's defined as the average of the wet bulb globe temperature index values used to determine the high humidity diurnal swing.

The wet bulb globe temperature index is the composite temperature used to estimate the affect of temperature and humidity on humans. This is

defined indoors as the dry bulb temperature multiplied by .3 plus the wet bulb temperature multiplied by .7.

The site parameter value of 86.6. degrees Fahrenheit was derived by considering the 0 percent exceedance wet bulb temperature of 88 degrees Fahrenheit and assuming a coincident dry bulb temperature of 92 degrees Fahrenheit and a daily dry bulb temperature range of 8 degrees Fahrenheit. These are the assumptions used in the DCD control room habitability area heat-up analysis.

In our example the corresponding site characteristic value is a function of the difference between the wet bulb globe temperature index at the 0 percent exceedance wet bulb temperature which is 75 degrees Fahrenheit and the wet bulb globe temperature index at the highest of the three daily low wet bulb temperatures that occur before and after 0 percent maximum wet bulb temperature.

CONSULTANT WALLIS: This is where my point comes up. Your 58 there is not really the maximum for the day, is it? The maximum for the day is actually at dawn or something.

MR. HARVEY: Yes, but if I picked a higher temperature, then I think they are going to get --

CONSULTANT WALLIS: There is hardly a

maximum.

MEMBER STETKAR: You're right, Graham. If you look at the second ash mark there where the wet bulb temperature is about 70 degrees Fahrenheit and the dry bulb temperature is about 73 degrees Fahrenheit, the average of that is 72 -- 71.5. The average of the two that are noted there is 63.

It's 10 degrees lower so that taking that dotted line temperature between 75 and 58 taking the average of that, or those two values, multiplying those in the formula and then averaging between Value A and Value B, the black points and the red points, will give you a lower temperature than if you, I believe, used the two points at, let's call it, midnight 70 and 73. Won't you?

CHAIR CORRADINI: If I could just interject. I thought -- maybe I misheard. Wayne's original note was you find the highest and then you use those for three days running.

MEMBER STETKAR: No, this is some sort of different average.

MR. MARQUINO: No, but what we've committed to do, what we have done in the analysis and committed in the DCD to do is to take one day and apply it three times.

Antonio, can you confirm that, please?

MR. BARRETT: Yes. That's correct, Wayne.

CHAIR CORRADINI: So I think, John, it's still bounded by the worst case.

CONSULTANT WALLIS: It says highest of three daily low wet bulbs is 58. I really question whether that's the right number to use because it's not the maximum that day.

MR. BARRETT: The highest of the three daily wet bulbs is the 75.

CONSULTANT WALLIS: No. I'm looking at the -- it says highest of three daily low wet bulbs is 58 so 58 is the highest wet bulb on that day.

MEMBER STETKAR: Let me just for philosophical discussion give you an actual example. I just did the calculation. I have a spread sheet here. If I take the values that you've highlighted there, I understand how you calculated 72.1. I can reproduce that. I understand the formula now.

If I use rather than your first highlighted 75 and 58, if I use 73 and 70, which is apparently actual data, plug those into the same formula I get 75.95.

CONSULTANT WALLIS: That's a big difference.

MEMBER STETKAR: Four degrees higher. I don't understand what these all mean now.

CONSULTANT WALLIS: This is the standard way of doing things?

MR. HARVEY: Well, this is the first of its type because this is the first --

MEMBER STETKAR: I understood what it was before when I had 88 with an 8 degree swing and I took that sinusoidal over three days.

CONSULTANT WALLIS: The thing is sinusoidal and they're in sequence. They're in phase.

MEMBER STETKAR: It's simple.

CONSULTANT WALLIS: But they're not usually.

MR. MARQUINO: So what this means is we have an analysis in place in the ECD and an applicant is trying to determine whether their site is bounded by our analysis. Our analysis is simple. It has one cycle repeated three times. It establishes a maximum and an average. What the staff is showing here is how you would take real world data and show whether you are bounded by that.

MEMBER STETKAR: Wayne, let me ask you. I know we're long on time but that's okay. Our job is to understand things. Suppose that in your DCD rather

than 86.6 which is derived from the values you used, the value in the DCD was 73. Just suppose. The way that these data, as we see on the slide, are calculated, this particular site would say, "I meet those criteria the way that these data are calculated," because it's lower than 73.

On the other hand, if instead of taking the two black dots I took the midnight 70 and 73 degree temperatures, this site would not meet that 73 degree criterion because it would be 76 degrees. I understand what you're saying in terms of how you specified the range. What I'm curious about are the prescribed way that a site is to do the calculation to confirm that they, indeed, meet that 86.6 degree.

CONSULTANT WALLIS: The highest of three daily low wet bulbs but there is no low wet bulb of 58 really in that day. That's not the lowest.

MS. CUBBAGE: I just wanted to clarify something you just said, John. They have to meet the 86.6 period. Right?

MEMBER STETKAR: Yes, but, Amy, what I'm curious about is forget the 86.6 for the moment. Let's say that the analysis that was done in the DCD said that you have to meet 73 degrees.

MS. CUBBAGE: I'm getting confused so

we'll let others.

MEMBER STETKAR: As an example say the criterion is 73 degrees rather than 86.6. I'm just trying to show an example that says how you calculate these values can affect whether or not you meet that criteria.

MR. HARVEY: The 58 is intended to be the highest of the three daily low.

CONSULTANT WALLIS: Actually, the low is --

MR. HARVEY: The low is actually lower than 58.

CONSULTANT WALLIS: 54 or something.

MR. HARVEY: You're picking the lowest value that occurred during that day, not the highest.

CONSULTANT WALLIS: Which should be 54.

MR. HARVEY: Which could be 54. I conservatively decided it was 58.

CHAIR CORRADINI: John, I understand what you're going through but I guess I want to ask the staff is the procedure that GEH is using an accepted procedure or an invented --

MR. HARVEY: Invented.

CHAIR CORRADINI: -- ad hoc procedure that the staff has reviewed? I thought it was an accepted

procedure with ASHRAE at least with some backup from the standard. Am I wrong?

MR. HARVEY: I think it's probably more the latter, ad hoc. I spent a lot of time on this because I had never seen this before. Control design is unique being passive.

CONSULTANT WALLIS: I think John has a point that it has to be unequivocal how you define maximum and lowest and things like that.

MEMBER STETKAR: Especially because you're taking -- for this particular one you're apparently taking some sort of average over that period.

CHAIR CORRADINI: So, John, can we leave this as an item to be clarified by staff?

MEMBER STETKAR: Yes.

CHAIR CORRADINI: Because, if I understand correctly, staff is --

MS. CUBBAGE: It's my understanding we should try to resolve it today if we can. I don't know if this is too complicated. I think this is pretty conservative.

MR. HARVEY: Yes, the 58 is supposed to be the highest of the low temperatures.

MS. CUBBAGE: The highest of the lows.

MR. HARVEY: Of the lows. All right.

CONSULTANT WALLIS: I think you need to look at different shapes of the curves and see where you've got a really equivocal definition and if it makes a difference. I think you need to examine that. That's all. Maybe it's easier to clarify.

MEMBER STETKAR: It might be easier to clarify and perhaps I'm not understanding what the --

CONSULTANT WALLIS: I think there is some equivocal -- it looks like an equivocal method at the moment.

MEMBER STETKAR: It does.

CHAIR CORRADINI: Can I rephrase? What I think John has brought up is that given the example shown the method may not capture the worst case.

MEMBER STETKAR: Unless there is something that I'm missing in the method this concept of the highest of the lows and why that's more relevant than --

MS. CUBBAGE: Because you're getting less swing. If you went with the lowest of the lows then you would take your worst swing.

MR. HARVEY: It's going to bring the temperature down.

MEMBER STETKAR: Yes, but, for example, the way the calculation is done you see the .3 times 75 plus .7 times 58. That's one data point that you then average with the other data point. If instead of the 75 and 58 I use the 70 and 73 for that second data point.

MR. HARVEY: But that's not relevant. You're looking for the swing that occurred so the swing is -- you're right that 75 is already high so you're looking at the lowest value that occurred so what you want to do is pick the low value to determine what your swing is.

MEMBER STETKAR: You're trying to get some sort of weighted average between the two. Aren't you?

MR. HARVEY: Weighted?

MEMBER STETKAR: Well, you are assigning --

MR. HARVEY: The weighted average is coming up with a wet bulb globe temperature.

CONSULTANT WALLIS: Whatever the black lines drawn as dawn there or midnight or something, it makes a difference where you drawn the --

MR. HARVEY: That's midnight.

MR. McLAMB: This is John McLamb from GEH. If you look at this chart that's in front of us. We

have five low temperatures there from a swing. You want to pick the highest of those five low temperatures.

Now, although it does get a little bit colder on the 58 degree day, at the end of the day you can see that swing continues down to 52 so 52 would be the low considered for that swing down. 58 is the highest of the low temperatures there. As Amy pointed out a minute ago, that would give you the most conservative wet bulb globe temperature index average for that five-day period.

MEMBER ARMIJO: Why isn't it 70 or 69? Why isn't that the highest of the lows?

MR. McLAMB: The 70 or 69 would not be the low temperature for that swing. That's the high temperature for that day.

CONSULTANT WALLIS: That's the highest.

MR. McLAMB: You don't want to know the high temperature for the day. The high temperature day is the third day there. You see it's 75 and 95. The highest of the highs and the highest of the lows is what we're going for.

The highest low is a confusing concept because you want to think, okay, low, that's an extreme but we're looking over each 24 hour period or

each diurnal swing for the temperature and trying to find where the temperature gets down to the highest value although its the minimum for that day.

That's why 58 is chosen here. It just shows that the highest of the low temperatures over those five days. It's not the highest temperature on that day we're going for. We want to find the highest low temperature on any five days.

MS. CUBBAGE: I think there may be some confusion the more I'm looking at this. It looks like the highest of the lows was 75 and then you picked 58 because it was coincident with the 75. No?

MR. HARVEY: No.

MR. BARRETT: Sorry. It's wet bulb temperature so we're getting the highest of the low wet bulb temperature which will give you the worst wet bulb globe temperature value.

MR. MARQUINO: The overnight low temperature is the one that is numerically represented there so the 75 is not an overnight low wet bulb temperature. It's a daily high wet bulb temperature. I suggest --

CONSULTANT WALLIS: Move on.

MR. MARQUINO: -- caucus during a break.

CHAIR CORRADINI: That's what I said

because we're not going to solve this.

MS. CUBBAGE: And in the future for folks on the phone, please identify yourself each time. The transcriber is getting --

CHAIR CORRADINI: Antonio was the last one.

MS. CUBBAGE: Before that was John McLamb.

CHAIR CORRADINI: Brad, why don't you continue. We'll let you caucus and we'll get back after a break. Go ahead.

MR. HARVEY: Why don't we go to --

CHAIR CORRADINI: You're right on time.

MR. HARVEY: Wind loading criterion. Change the subject a little bit. Another technical topic I would like to discuss came up during the committee's June 22nd meeting on SER Chapter 22. This issue is whether RTNSS-related structures are being designed to a more conservative hurricane wind speed criteria of 195 miles per hours as compared to seismic Category 1 structures which are being designed to an extreme wind loading criterion of 150 miles an hour and 150 miles an hour is a site parameter value in DCD.

Besides being designed for an extreme wind load of 150 miles an hour seismic Category 1

structures are also designed for tornado loads which include a combination of 330 mile an hour winds and tornado missile loads. Similarly, Category 2 structures are designed for tornado windload of 230 miles an hour but they are not designed for tornado missile loads.

In conclusion, Category 1 and 2 structures are designed to withstand higher windloads in RTNSS structures because they are designed to withstand tornado windloads.

MEMBER STETKAR: Brad, I understand that. No, let's go on. I had a question about how the 100-year return period is calculated for high winds because it's not at all clear to me how taking a square root of a 1.15 multiplier times a 50-year recurrence period gives you for some reason any information about a 100-year return period maximum wind speed. It sounds like somebody --

MR. HARVEY: It's an algorithm that's been developed that you can use.

MEMBER STETKAR: Is the algorithm based on actual wind data?

MR. HARVEY: It's under the ASCE standard.

MEMBER STETKAR: Is it based on actual wind data?

MR. HARVEY: It's based on calculations of --

MEMBER STETKAR: Based on actual wind data?

MR. HARVEY: During the return period.

MEMBER STETKAR: We don't have time to belabor this point. It sounds like a made up way of setting 100-year return periods. This is why we have problems with 100-year return floods happening three times in a decade, for example, because people who set design criteria made up rules 50 years ago that aren't derived from actual data.

CHAIR CORRADINI: I'm not understand your point, John.

MEMBER STETKAR: The point is that they use wind speed data that are supposedly derived from actual data and look at a 50-year return period maximum wind speed. Then they multiply that wind speed by the square root of the SEI ASCE 7-02 essential facilities importance factor of 1.15 to account for a 100-year recurrence period windspeed.

CHAIR CORRADINI: They multiply it by a little bit over 1.

MEMBER STETKAR: Yes. If you have 140-mile per hour maximum wind speed occurring once every

50 years, you would get 150 mile maximum wind speed occurring once every 100 years which to me sounds not to account for actual --

MR. HARVEY: Actually, the 1.15 is the wind load, not the wind speed.

MEMBER STETKAR: I'm quoting now from the SER. It says, "The applicant based its extreme wind site parameter of 67.1 meters per second, 150 miles per hour for seismic Category 1, 2, and radwaste building structures on multiplying a 50-year return period value of 62.6 meters per second, 140 miles per hour by the square root of the SEI ASCE 702 essential facility's importance factor of 1.15 to account for the 100-year recurrence.

That's what it says. If you do that math you get scaling from a 50-year return period maximum wind speed of 140 miles per hour to a 100-year return period of only 150 miles per hour because, as you said --

CHAIR CORRADINI: Just so I get it, your point is --

MEMBER STETKAR: My point is that does not seem to account for actual variability in maximum wind speeds that we see from meteorological records.

CHAIR CORRADINI: Is this something that

is an accepted practice?

MR. HARVEY: That is the ASE standard. Yes.

CHAIR CORRADINI: Okay. I guess my only point is I'm not sure what they can use in difference to the standard.

MEMBER STETKAR: Actual meteorological records.

MR. HARVEY: But there would also be a statistical exercise to look at historic data.

CHAIR CORRADINI: I just want to make sure I understand your point. Your point is that the approach used here, although a standard, doesn't seem to capture the 100-year return.

MEMBER STETKAR: It does not nearly seem to account for the observed variability over periods of time as long as a century.

CHAIR CORRADINI: Okay.

MEMBER STETKAR: We're talking about a century's worth of meteorological data and trying to infer variability based on a formula rather than actual observed meteorological data.

MR. HARVEY: Okay. In conclusion, the applicant has provided plant specific site parameters and the staff finds those acceptable. The applicant

has properly identified the site specific information to provide as part of the COL application and all issues for the SER with open items have been addressed.

CHAIR CORRADINI: Just so I'm clear, we're going to come back and clarify the procedure being used so that we are clear that you guys, staff and applicant, are on the same page relative to the temperature.

MEMBER STETKAR: Let me ask two more things.

CHAIR CORRADINI: Sure. Go ahead.

MEMBER STETKAR: Number 1, this section of the SER really bothered me because I couldn't figure out whether it was talking about Rev. 6, Rev. 7, or Rev. 8 of the DCD. There are quotes that say that the analyses are based on Rev. 6 of the DCD and supplemental responses to RAIs.

It's obvious the information we're talking about is the control room heat-up that is based on information in Rev. 8 of the DCD which we don't even have. There is work to be done, Amy, to make this consistent with, I guess, Rev. 8 of the DCD because there are references in the SER to footnotes and tables that don't exist even in Rev. 7 of the DCD.

Somebody needs to do some pretty careful editing.

MR. HARVEY: Actually, it's in the statement in my introduction to this section to reference Rev. 6 of the DCD. That should be taken out. The SER as written reflects the latest information that we know beyond Rev. 7.

MEMBER STETKAR: Beyond Rev. 7?

MR. HARVEY: Beyond Rev. 7. It references a couple RAI responses that are beyond Rev. 7 so that Rev. 6 is a mistake in my introduction paragraph and should not have been there.

MEMBER STETKAR: One point that I do need to make, a slide that you skipped over at the end was the screening of external hazards. I don't know, Mike, because of the time when or if we should discuss this. I have a real problem with --

CHAIR CORRADINI: Which slide are you looking at, John? I'm sorry.

MEMBER STETKAR: I'm looking at --

CHAIR CORRADINI: This is slide 15?

MEMBER STETKAR: 14 and 15 --

CHAIR CORRADINI: Yes, sir.

MEMBER STETKAR: -- of the presentation which we skipped over.

CHAIR CORRADINI: You're worried about the

split point?

MEMBER STETKAR: I'm worried about having in the rule, the licensing rule, a specific value that says it's okay to screen out any external hazards whose frequency is less than a specific numerical value that value being 10 to the -7 event per year. That puts into law that number.

MR. HARVEY: That's isn't Tier 2. Is Tier 2 going to be part of this?

MEMBER STETKAR: It's also in Tier 1. It's in Table 5.1-1 of Tier 1. Go look it up.

MS. CUBBAGE: As it stands now that screen criteria is consistent with our SRP.

MEMBER STETKAR: And, by the way, the information on slide 15 I don't understand at all because indeed the PRA should include everything even down to 10 to the -8 and below.

CHAIR CORRADINI: You kind of changed subjects on me. I want to make sure. Amy's answer at least --

MEMBER STETKAR: I understand Amy's answer.

CHAIR CORRADINI: You don't agree with it?

MEMBER STETKAR: I don't agree with it. I understand it but it's in the SRP and it's the

available guidance. I have real problems for a plant that has supposedly an estimated core damage frequency in what is called the mid minus, the 10 to the -8 range that accounts for internal and external events, all hazards during all plant modes of operation that we can just say we're going to throw out things because they occur less frequently than 10 to the -7 event per year, or maybe less than 10 to the -6 event per year.

I'll grant you in the tables it's actually 10 to the -7. The problem I have with that is I recognize the standard review plan guidance. I have a real problem with codifying that umber in a rule as a force of law.

CONSULTANT WALLIS: One of those events could account for more core damage than --

MEMBER STETKAR: Than everything else together.

CONSULTANT WALLIS: -- everything else together.

MEMBER STETKAR: That's true.

CHAIR CORRADINI: I guess I have to ask again --

MEMBER STETKAR: In regulatory guidance I can understand it.

CHAIR CORRADINI: Let me just ask Amy.

Is this something from the rule standpoint any different than what occurred in AP1000 in ABWR? I didn't think so.

MS. CUBBAGE: I don't believe so.

CHAIR CORRADINI: So I guess I would put this in a generic list that we've got to check on. I understand your concern. I'm just not sure if staff is doing anything different than what they've done in the three previous design certifications. That's what I guess I'm struggling with but I've got it. I think I've got it. I'm sure you're going to write it up and help me because this one is a little more complex than the last two.

MEMBER STETKAR: This one is more complex because it actually places in the rule a specific numerical value.

CHAIR CORRADINI: I understand.

MEMBER STETKAR: That's my biggest concern. If it were not for the fact that numerical value was in the rule licensing this design, I would still have philosophical qualms about doing the screening but that would fall more over into the PRA space and COL applicants justifying why they screened out specific external hazards.

CONSULTANT WALLIS: With these very low core damage frequencies you could screen out everything of any significance.

MEMBER STETKAR: Sure. That's all I wanted.

CHAIR CORRADINI: Okay. I'm going to thank the staff. I think we should take a break now in difference to the schedule since we're a dad over. We get back here at 10:20 and start on Chapter 12, Radiation Protection.

(Whereupon, at 10:08 a.m. off the record until 10:27 a.m.)

CHAIR CORRADINI: Okay. Let's get started.

MR. KIRSTEIN: Good morning. My name is Erik Kirstein from GEH. I'll be discussing ESBWR DCD Chapter 12, Radiation Protection. The open items from the SER back in 2007 we had 28 open items identified in the SER. All have been resolved since. What I want to talk most about here, at least early on, would be open items 12.7-1 through 12.7-3.

Then in conjunction there are other open items of interest, 12.2-9 which deals with the inputs and assumptions that lead to our calculation of the gaseous effluent releases in DCD Table 12.2-16, and

also the post-accident radiation information in DCD Section 12.3, the fact that it was incomplete at that time.

Open items 12.7-1 through 12.7-3. There is a typo in the NUREG. That last 8 should be omitted. It's 3587. The application of this particular -- 12.7-1 deals with the application of that particular NUREG in terms of decommissioning the saltation techniques and the features in the ESBWR design.

12.7-2 has to do with decommissioning operations, how they are facilitated in the design and how radwaste generation is minimized during the decommissioning. 12.7-3 deals with identification of any below-grade piping or components that have the potential of leaking radioactive contaminated fluids.

As can be seen, all three of these actually tie to the conformance of 10 CFR 20.1406, minimization of contamination. Just to refresh everyone, I've put the text of that particular regulation here in the slide. The important one is Item B for standard design certifications and I've underlined the important text, I guess.

The applicant shall describe in the application how the facility design will minimize

contamination of the facility and the environment, facilitate decommissioning and minimize generation of radwaste.

This chapter was first presented in October of 2007 to the ACRS. It's been almost three years. Since then Reg Guide 4.21 was issued which provides some guidance as to how to adhere to this particular regulation. The Reg Guide is 4.21 called minimization of contamination and radioactive waste generation and lifecycle planning. It was issued in June of 2008.

CONSULTANT WALLIS: How did they define minimization? How do you know you got there?

MR. KIRSTEIN: Minimization can be seen in the regulation to the extent practical.

CONSULTANT WALLIS: There is always a way you can get a little bit more, little bit less.

MR. KIRSTEIN: Similar concept to ALARA. Definitely not a quantified item.

CONSULTANT WALLIS: By spending more money you can always reduce it.

MR. KIRSTEIN: Absolutely. This particular Reg Guide 4.21 does provide guidance in conforming to this regulation. Appendix A of this Reg Guide list examples and measures to control

contamination.

As a result, these three open items, or these three RAIs in particular, were closed out after this Reg Guide was issued and RAI 12.7-5 was issued sort of summarizing and kind of lumping them all together and just requesting information to address this particular guidance of Reg Guide 4.21.

MEMBER RYAN: Did some of that lead you to the EPRI guidance on on-site storage because I'm sure most plants are at least thinking about that alternative given that there is no outlet whatsoever at this point.

MR. KIRSTEIN: I'm not too aware of that at the moment.

MEMBER RYAN: That would be something I think would somehow factor into the staff --

MR. KIRSTEIN: During operation because we looked at it more from a design standpoint.

MEMBER RYAN: There is no disposal site in the United States that will take B and C waste today and the horizon for seeing one of those is fairly long in my view. There is probably a little bit more emphasis needed for onsite storage for some period of time with ultimate disposal being the goal for generating waste.

MR. KIRSTEIN: I'm not sure how much detail is discussed in 4.21 but that is the goal.

In terms of resolving this particular RAI GEH in Rev. 6 of the DCD we added some information in our first attempt to sort of try to adhere to this particular regulation and we put that information in DCD Section 12.6. Since the Reg Guide was issued the request in that particular RAI was to relocate that information into Section DCD 12.3 to be consistent with the SRP. This information was moved over to 12.3.1.5 to satisfy that particular RAI.

MEMBER RYAN: Let me try it another way. If you're following this guidance you could end up with two outcomes. One is onsite storage or off-site disposal and try to get across that some of the criteria that leads you to one or the other might be different on what your strategies are so you meet disposal requirements versus onsite storage requirements so it needs to be a broader question given that onsite storage might be something you have to think about.

MR. KIRSTEIN: In Rev. 6 GEH added DCD 12.3-18. This is quite a massive table. I think it's some 30-odd pages or so. It essentially provides a good cross-reference between the nine design

objectives in Reg Guide 4.21, six of which are tied to the design process and the design of the plant. I think seven through 9 are more from an operational perspective. This particular table points to various sections in the DCD of where these design objectives are discussed and addressed.

Also, like I mentioned, I think three of the design objectives in Reg Guide 4.21 are more relevant to the operation of the facility, not necessarily the design. As a result GEH created COL Item 12.3-4-A to address the operational and post-construction objectives of Reg Guide 4.21.

MEMBER ARMIJO: And that hasn't changed as you've gone to Rev. 6 and Rev. 8?

MR. KIRSTEIN: The COL item is the same. That's correct.

Moving on, another particular open item of interest is 12.2-9. In summary, the staff had difficulty duplicating the effluent releases, the gaseous effluent release concentrations in DCD Table 12.2-16. To resolve this particular open item GEH added Appendix 12B in Rev. 5 to provide the details that form the basis for the calculation of these concentrations.

Appendix 12B contains equations supporting

these releases, more detailed highlighting of the assumptions and the particular inputs that went into the calculation. To summarize, at least, what you see in Appendix 12B, the methodology is very similar to NUREG 16 which is the NUREG supporting the BWR GALE code.

MEMBER RYAN: That satisfies the staff questions?

MR. KIRSTEIN: Yes. Lastly, Open Item 12.4-31. This is kind of extensive. There were a couple of supplements as related to this RAI. The summary of that particular open item is the post-accident radiation zone maps that existed in DCD Section 12.3 are incomplete.

At the time we had only provided them for the nuclear island. We had only provided the dose rates in vital areas and access pathways. The request was to provide a description of the post-accident missions and the actions of the personnel in those particular vital areas and the mission doses.

To resolve this open item GEH added DEC Tables 12.3-12 and 12.3-13. These tables contain the detailed dose rates in the post-accident rooms and in the access ways. In addition, we added Table 12.3-14 through 12.3-17.

These tables listed the estimated mission doses for the vital area access.

We also revised nuclear island post-accident radiation zone maps and also added detailed maps for the electrical and service buildings where some of the post-accident missions were to occur.

Lastly, GEH also added DCD figures depicting the personal access and egress routes to and from the vital areas to allow the staff to confirm the actual mission doses that were calculated heading to and from these particular vital areas in the event of design-based accident.

As a summary, Chapter 12 open items have been resolved to address the 10 CFR 20.1406 criteria per the Reg Guide 4.21 guidance GEH moved the information to DCD Section 12.3.1.5 and added the Table 12.3-18 which provides the cross-referencing to other areas of the DCD where the 4.21 design objectives are met.

Appendix 12B was added to Chapter 12 to provide the staff enough information to confirm the basis for the gaseous effluent releases from the site supporting DCD Table 12.2-16. Lastly, to satisfy the mission dose RAI or open item, GEH added numerous figures and tables to the DCD to provide enough

detailed information in terms of radiation zones, access and egress routes, mission dose rates, and the resulting doses in a post-accident environment from a design basis LOCA.

I'll take any questions anyone may have with respect to Chapter 12.

MEMBER RYAN: Sure. I've got a couple. Could you talk a little bit more about the prevention of groundwater contamination and early detection of groundwater contamination and how you address that with design. I know it may be early and it could very quickly become a site-specific question. I understand that.

MR. KIRSTEIN: From a groundwater perspective I might have to get back to you on that. I know in terms of leak detection that is one of the Reg Guide 4.

MEMBER RYAN: That's a good first step.

MR. KIRSTEIN: Yes. I know in DCD one of the pointers we have in Table 12.3-18 we refer to Section 3.8 which discusses the -- well, the actual design objective in Reg Guide 4.21 to sort of paraphrase it talks about leak detection methods for early detection where inspections might be difficult or impossible.

The second design objective also is similar, leak detection capability. In DCD Section 3.8 we talk about we have liner welds for all the pools, outside containment, and they are backed by leak chase channels and detection systems. As you know we've got many pools in the ESBWR. For those outside containment we definitely have measures in place for early detection of any potential leak.

MEMBER RYAN: How about prevention?

MR. KIRSTEIN: Prevention? I know we do have liners. I'll have to confirm that but I think the pool liners would be the first --

MEMBER RYAN: And then things like double-walled piping with leak protection in between. Is that all included?

MR. MARQUINO: This is Wayne Marquino. We added a specific section in Chapter 12 that commits to apply double-walled piping to avoid unmonitored leakage. We've had several reiterations with the staff where our initial commitments we tried to exclude by condense blowdown that was going to lake and river. Staff made us commit to having that go through double-walled piping. We have made very extensive commitments to make sure that we don't have unmonitored leakage to the groundwater.

MR. KIRSTEIN: Another example I guess earlier on in the DCD revision process was we have liners in the tank cubicles in the radwaste building which go up to the level, at least above the level.

MEMBER RYAN: I notice that you've got the level set so that overflow is very low risk.

MR. KIRSTEIN: Yes.

CHAIR CORRADINI: Other questions? Okay. Thank you, Erik.

MEMBER RYAN: Oh, I'm sorry.

CHAIR CORRADINI: Go ahead.

MEMBER RYAN: I had one other question. There was a comment that you've got an estimate of cumulative annual dose operating in the ESBWR will be .845 person-siverts or 84.5 person-rem and that's consistent with 100-person rem EPRI design guideline. How does that break down? The reason I'm asking I'm curious if somewhere between the five-rem and the two-rem, that kind of thing, how many are below two and how many are above two? I'm just curious.

MR. KIRSTEIN: There is some detailed information. I don't know the numbers off the top of my head but if you go into DCD Section 12.4 there is a significant amount of tables. We've got the summary and then it breaks down actually as a function of all

the other subpaths that might answer your question.

MEMBER RYAN: Okay. Great. Thanks a lot.

MR. KIRSTEIN: Sure.

MEMBER RYAN: There are some in the three to five I'm guessing.

MR. KIRSTEIN: I would think so, yes.

MEMBER RYAN: Okay. Thanks.

CHAIR CORRADINI: Thank you very much.

Dave, you're back up with help.

MR. MISENHIMER: Once again, my name is Dave Misenhimer. I'm Chapter PM for Chapter 12. Today we'll have Charles Hinson and George Cicotte to discuss the open RAIs that we're going to present.

Charlie.

MR. HINSON: Hi. My name is Charles Hinson and I'm the primary reviewer for Chapter 12 Radiation Protection. There is some information in Chapter 12 on effluent releases and the original reviewer for that was John-Claude Dehmel. The current reviewers is George Cicotte. One of the three RAIs that we're going to discuss today is in that area. The other two are in my area.

GE pretty much gave a pretty good history of 10 CFR 20.1406, how it will minimize the extent of contamination of the facility and the environment,

facilitate decommissioning and minimize radwaste.

We initially issued three RAIs which were discussed in 12.7-1 through 12.7-3 back in 2006 to have the GE address how they comply with 2014.06. After we issued those RAIs we started work on Reg Guide 4.21 which was meant to provide more guidance to the staff on how to assess an acceptable program that would comply with 2014.06.

In June of 2008 Reg Guide 4.21 was issued and slightly before that, six months before that, the staff pretty much took what was unresolved in the first three RAIs, 12.7-1 through 12.7-3, and we folded them into a new RAI 12.7-5 which incorporates the design and operational objectives that are contained in the Reg Guide. We asked 12.7-5 to get more detailed information from GE and how to comply with 2014.06.

So essentially Open Item 12.7-5 asked GE to provide a general description of how each of the objectives, both design and operational in Reg Guide 4.21 will be met. For each of these design objectives we asked them to provide several examples of ESBWR design features to illustrate how each of these design objectives are met in the ESBWR design.

We also asked GE to identify the COL

action item or items associated with each of the operational objectives that are referenced in Reg Guide 4.21. We asked GE to describe the design features associated with each of those specific plant SSGs which may generate radioactive waste.

These SSGs are described in ISGL-6 which is interim staff guidance on how to comply with 2014.06. We also looked at historical systems that contain radioactivity that have leaked in the past and so we asked GE -- we identified them in our RAI and asked them to provide design features for each of these.

Finally, we asked GE to identify any plant systems which may have buried piping carrying radioactive fluids and describe the features to minimize potential unmonitored leakage from these pipes.

Next slide. In response to this RAI, as Erik said, GE added a new subsection in Chapter 12 and also a 61-page table, Table 12.3-18, in the DCD to address the Reg Guide 4.21 design objectives. The changes included in the new sections and tables include a detail listing of ESBWR design features incorporated to address each of the design objectives in Reg Guide 4.21. And also a reference pointer or

road map to indicate where each of these design features was further described in the DCD.

To adequately evaluate GEH's response the staff could not get awareness training with selected branches to discuss 10 CFR 20.1406, ISG-06, and Reg Guide 4.21 objectives. Then our branch also requested that other branches review the new DCD table for completeness and accuracy and to assess the impact of 20.1406 on their review areas. In comments that we received back from these various branches were included in supplemental RAIs to 12.7-5.

Next slide.

MEMBER RYAN: Is that a fairly expensive list of RAIs? Can you give us a little hint as to what was covered in the breadth of that follow-up set of RAIs?

MR. HINSON: Yes. I mean, the initial RAI was quite extensive and then we sent this resulting table to the other branches. In some cases they asked their own questions separately. In other cases they asked questions of the table and said that these were incorrect statements or they needed to expand on the table. That was Rev. 1 and GE came back and made corrections to the table to address comments. Like I said, some of the branches issued their own

independent RAIs through their branch.

MEMBER RYAN: Is that process closed off now? Is it pretty well done? Everybody is happy with the table now?

MR. HINSON: Yes.

MEMBER RYAN: Okay. Thank you.

MR. HINSON: Sure. Okay. Also GE created COL information item 12.3-4-A to address the operational objectives in Reg Guide 421. This COL item states that the COL applicant will address the operational and post-construction objectives of Reg Guide 421.

NEI 08-08 addresses the operational objectives described in this Reg Guide as it is intended to assist the COL applicants in addressing the operational compliance with 20.1406. NEI 08-08 was issued about a year ago and the title is Generic FSAR Template Guidance for Lifecycle Minimization of Contamination. Like I said, it provides guidance on the resolution of this COL information item 12.3-4-A.

In response to a supplemental RAI that the staff issued concerning underground piping and leakage, GE identified the four ESBWR SSCs that had associated buried piping and described the design feature of this buried piping that would minimize the

potential for unmonitored, uncontrolled releases of radioactivity to the environment.

This included these pipes were either enclosed within a guard pipe and monitored for leakage or accessible for visual inspections via trench or tunnel and this is why the radwaste piping goes through a tunnel. All joints in these piping are welded with flange connections for use underground and fittings will be kept to a minimum and no in-line components will be incorporated into these lines.

CONSULTANT WALLIS: So visual inspection when it's releasing radio activity?

MR. HINSON: Well, for leakage.

CHAIR CORRADINI: You would look for leakage first I would assume.

CONSULTANT WALLIS: What is it leaking is the question.

CHAIR CORRADINI: Then they would have to do some sort of --

MEMBER RYAN: Charles, I don't recall. Is there any specification or guidance on materials or construction for these underground pipes that are preferred over maybe others that are not?

MR. HINSON: Well, let me see. The piping is usually, like I said, doubled walled where it's

underground so if there are leaks that it would go into the second.

MEMBER RYAN: Hopefully there is a detector in there somewhere that would see it. That doesn't really address the materials of construction. I'm thinking of the range of weather systems. Sometimes PVC works great and sometimes it doesn't and things like that.

MR. HINSON: The COL applicant usually specifies the type of piping.

MEMBER RYAN: That's down the line.

MR. HINSON: Yes, it's down the line.

CHAIR CORRADINI: But I do remember, and maybe I'm getting confused and I'm getting North Anna mixed up with the DCD but I seem to remember we had a discussion bout this. I'm looking at Sam.

MEMBER ARMIJO: I'm trying to remember that.

MS. CUBBAGE: Yes. There was an open item on North Anna relative to the buried piping.

CHAIR CORRADINI: That's what I thought. Okay. So this really isn't in the COL ballywick that's going to be brought up eventually.

MEMBER ARMIJO: There was a discussion, I believe, on PVC piping and joints and things like

that.

MS. CUBBAGE: That's right.

MEMBER ARMIJO: I imagine this would include carbon steel and stainless steel and everything else.

MR. HINSON: The guidance talks a little bit about durability and the environment it's in and a little bit of general stuff like that but not so specific.

MEMBER RYAN: Charles, you might not want to bang your paper on the microphone.

MR. HINSON: I'm sorry.

MEMBER RYAN: It's okay for us but the recorder gets a much louder noise.

CHAIR CORRADINI: If we hear him flop over, we know we have gone beyond the decibel level.

MR. HINSON: Blew out his ears.

CHAIR CORRADINI: Go ahead.

MR. HINSON: Okay. On the basis of the staff review of the response to this RAI the staff finds that GE has adequately described how the ESBWR design meets the design objectives of Reg Guide 4.21 and complies with 10 CFR 20.1406 by minimizing contamination of the facility and environment, facilitating decommissioning and minimizing the

generation of radioactive waste.

The second RAI in my area was 12.4-31 which had to do with post-accident access radiation zones. The staff asked GE to provide a complete set of post-accident radiation zone drawings reflecting the maximum post-accident dose rates for areas requiring post-accident access. We asked them to identify all areas which require access following an accident to mitigate the consequences of an accident.

These are defined as vital areas for NUREG-0737 Item II-B.2 which is also 10 CFR 50.34(f)(2)(vii). Finally, we asked GE to indicate access routes to and egress routes from each of the vital areas along with the corresponding mission dose rates for these vital areas.

In response to this RAI GE provided a list of all vital areas and post-accident actions required to be performed in each of these vital areas. We're talking about 15 vital areas that they identified. They also provided a list of estimated post-accident dose rates in each vital area and access ways to vital areas after an accident from half an hour up to 30 days.

Then they performed an analysis detailed breakdown of mission doses to each of these vital

areas including the dose incurred for each room traversed to the vital areas. They did this analysis for 72 hours following an accident. This is what the staff was asking for that showed all the access routes and analyze the dose in each portion of the route traversed en route to the vital area and away from the vital area. None of the mission doses exceeded the GDC criteria of five-rem following an accident.

In one case the staff noted that the mission dose to the stand-by liquid control pump room was approximately four-rem and close to the GDC limit. The mission that was accomplished by accessing this vital area was to provide long-term boron refilling. The staff asked GE why this dose was so high. They came back and said all the missions had been analyzed for 72 hours and there was no real requirement for forming long-term boron refilling at this 72-hour point.

They said that if needed this action would be performed at a much later time than 72 hours. Probably at seven days after the accident. At this time the dose rate would drop down so that the mission time would be increased from five minutes to four hours so they would have plenty of time to plan this mission. They put a footnote on this table stating

that this room did not need to be accessed in 72 hours. That's how they resolved that concern.

On the basis of GE's response the staff concluded that GEH had adequately addressed the requirements of 10 CFR 50.34(f)(2)(vii) as they apply to plant shielding of vital areas and the criteria in NUREG-0737 Item II.B.2 and this resolves this RAI 12.4-31.

CHAIR CORRADINI: Okay.

MR. HINSON: The third RAI is George's area.

MR. CICOTTE: My name is George Cicotte and I assumed responsibility for the review of this part of Chapter 12 last year. This original issue was there were some issues in the way that the modeling was done. There was some information that the staff was not able to discern as to input parameters to the computer modeling to determine what the effluence would be and, thus, what the resulting estimated doses would be. Also some of the in-plant occupational doses.

Over a series of supplemental RAIs and the applicant's responses to those we were able to discern what modeling process they used and we were able to both duplicate sufficiently their information and our

own independent assessment to determine what the doses were and the concentrations resulting in doses such that we were able to conclude they did not exceed 10 CFR 50 Appendix I and that they didn't significantly under estimate the dose.

Based on the changes that they had made over four different revisions of the DCD we were able to conclude that they met the design objectives and that it was consistent with Appendix I and 10 CFR Part 20 effluent release limits. As a result of those RAI 12.2-9 was resolved.

MEMBER RYAN: You said four different revisions. Was there anything that was rather particular about their modeling that was new or different?

MR. CICOTTE: The questions were there were some things that were not included that we needed in order to do our assessment. There were some different computer models that were used for different purposes. It wasn't required that both models were acceptable but they changed the way they did it to make them all consistent. The additional questions were pieces of it that hadn't been answered the first time.

MEMBER RYAN: So you just were working

through some of the details --

MR. CICOTTE: The various issues.

MEMBER RYAN: -- of how they did what and all that. There was nothing bizarre or unique.

MR. CICOTTE: Correct.

MEMBER RYAN: Okay. Thanks.

CHAIR CORRADINI: Any other questions by members of the committee? Okay.

Thank you very much, George and Charles and Dave.

Now we are going to switch gears and go to human factors which is a closed session so we want to make sure the room is closed. Everybody's credentials have been checked? Okay.

(Whereupon, at 11:00 a.m. the open session was adjourned.)

A-F-T-E-R-N-O-O-N S-E-S-S-I-O-N

1:00 p.m.

CHAIR CORRADINI: So let's get started. Staff knows about Chapter 10. They're coming. I'll go get them.

Mr. Anthony, you're up.

MR. ANTHONY: Thank you, gentlemen. My name is Gary Anthony. I'm the principal engineer for GEH on the balance of plant side.

I'd like to make a short introduction. We had approximately 106 RAIs on Chapter 10 or dealing with our inversion systems in other DCD chapters.

Now we also had several telephone conferences conducted on technical topics and talked about design details and informed the NRC on how this equipment would be operating.

We published a bounding missile probability analysis report which is generated for a COL information item -- 102Alpha. I believe the last time I was here in 2007, the Committee had just been cued a copy of it. I don't believe it had been

reviewed at that time.

The NRC conducted a very thorough review of all of our safety-related and RTNSS Category B equipment taking a specific look at the orientation of locations with respect to potential turbine missile zones. Basically it's the plus on the left-hand side and the right-hand side of 25 degrees to the extreme at the low-pressure turbines. On the last page of this package, if you want to, there's a little picture of it. It's slide number 15. It shows the orientation out of the DCD chapter. We're called a favorably oriented turbine because we are not facing or pointing at any safety-related equipment.

The NRC did an exhaustive review of the turbine overspeed protection, single failure criteria, failure modes and effects analysis evaluations and isolation valve functions. We also did a control scheme that was completed. Basically this is for the stops, controls, intercepts, non-return valves -- anything that would assist the turbine in slowing down in case of a loss of control functions.

We did a substantial NRC review of flow-accelerated corrosion in materials for piping and valves and welding. And an ISI inspection was also conducted.

Bit of a busy slide. We had like five open items from the 2007 draft SER report with open items. I'm just going to go over basically the open items and they're basically in bold.

This first slide is about turbine control, materials and testing. The initial questions were diversity in the turbine overspeed trip devices since this new design uses two sets of electronic systems rather than an electronic and a mechanical system. So we spent a lot of time with the NRC informing them how the old mechanical didn't work as well as we expected and how we split and had single-failure criteria on this new system.

Extra slots, number 10 and 11, if you're interested discuss or show the pictures of our electronic control system. That slide 10 shows the six probes and the toothed wheel and how all of the electronics are now dependent on each other. And then the slide 11 shows the electric relay type arrangement and how that works.

CHAIR CORRADINI: So if I might ask then --

MR. ANTHONY: Certainly.

CHAIR CORRADINI: I know Mr. Stetkar wanted to hear this but he's being held in chains net

door.

So is this in Rev 8 -- this figure in Rev 8 of the DCD? If one wanted to find the figure within the DCD, where is it?

MR. ANTHONY: This figure is not in the DCD.

CHAIR CORRADINI: So how do we know --

MR. ANTHONY: Neither are these two figures.

CHAIR CORRADINI: How do we know you're actually going to stay faithful to this beautiful figure?

MR. ANTHONY: This is the General Electric standard speedtronic mark that is described in the DCD in Chapter 7. It's described in there in prose rather than all of the blocked diagrams.

CHAIR CORRADINI: Okay.

MR. ANTHONY: Now this was provided to the NRC during RAI 10.2-18.

CHAIR CORRADINI: Okay.

MR. ANTHONY: We supplied them all of the standard manuals that this equipment is built from.

CHAIR CORRADINI: Okay. All right. So this is the standard General Electric design and this is in response to the RAI?

MR. ANTHONY: That is correct.

CHAIR CORRADINI: Okay. All right. Thank you.

MR. ANTHONY: The NRC requested information on providing overspeed basis and margins safeties between turbine and primary emergency overspeed tripset points. We had some discussions on that. We had discussions on turbine ISI and inspection details. We spent a lot of time on turbine rotor material properties because actual turbine properties don't match what the standard review plan was. So we had to discuss with them how it met the intent of the standard review plan.

We also discussed with them generating a bounding turbine missile analysis report. Originally in our DCD's Rev 1, 2 and 3, it was not required until fuel load. We made an agreement with the NRC that we would generate a bounding one and that we'd add another COL action item such that when the actual turbine was built, the materials -- the certified material tester ports that the rotors came from would be matched to the missile probability analysis report and show that it was bounding. So we revised the COLs for those.

We had some discussions on how we tested

the original turbine rotors. And we went through the process of manufacturing a set of new basically called mono-block turbine rotors instead of the old disk built ones. And we discussed we do 100 percent UT and visuals and spin tests and what they're done at. And that satisfied the NRC on the quality of the materials that we were doing.

This 10.2 RAI discussed as I said in the introduction was the protection of RTNSS B equipment. Originally that wasn't reviewed. A part of the DCD is basically only safety. And the NRC asked us to do a formal review of Reg Guide 1.11 and 1.115 to ensure that there was nothing in the path of a turbine missile analysis. And we provided basically 10.2-18 Supplement 3 Rev 2 -- about 139 pages covering RTNSS and turbine controls for answers for them. And they used that as a basis for the SER and revisions to DCD Rev 7.

The next open item we came up with in 2007, we were still under discussion on whether we should endstamp the main steam lines. The regulation did not require it. It has a footnote saying that they did not need to be endstamped. The regulation -- REG Guide 126 was revised. The footnote was removed even though we were already into the DCD. We made a

comment in Chapter 3 that said that all the SME Class 1, 2 and 3 pipe would be Section 11 inspected. So we decided to endstamp the main steamlines. So now they're nonsafety, Seismic Class II main steamlines from the edge of the seismic support in the reactor building back to the turbine stop valves. So we agreed with the NRC on upgrading those.

Basically we did that so they would also give us acceptance on the main steamline isolation valve leakage control system. Basically that comes from SECY-93-087 for the seismic response to make them Class II and the NEDC report 31858 Rev 2 which is from the BW Honors group allowing the leakage rates to be much more than the old plants if we have high quality steamline drainlines and seismic condenser. The condenser would be reviewed to seismic criteria Class II. Basically that allowed our fission products to go from 20 standard cubic feet an hour to 200 standard cubic feet an hour using the condenser as a plate-out and containment mechanism.

The next open item was on the bottom of the page. The request was that we list main steam and feedwater pipe materials and weld materials. Chapter 10 was a little nebulous on actually what we were going to be using even though it indicated we would

use the same stuff as in Chapter 5 which is the main feedwater and main steam system. So they specifically requested us to make sure that we met the piping ASME Class 2 and 3 systems for piping. So pipelines is ASME Class II -- or Section 3, Class II with -- the balance of the plant is basically B3111 ASME type materials. And we'll talk about that in just a minute.

There's another open item from 2007. They were requesting why we wanted an alternate to Reg Guide 150 which is the minimum weld pre-heat temperatures. After a set of reviews on welding and materials, they agreed that the post-weld baking used met the intent of the Article D1000 minimum pre-heat temperatures. And NRC has reviewed that before and has accepted that on other plants.

(Whereupon, at 1:10 p.m., off the record until 1:11 p.m.)

CHAIR CORRADINI: Mr. Anthony, go ahead.

MR. ANTHONY: Okay. I guess we've gone over -- did you miss the first one? Or would you like me to go over the first one again on the stage?

COURT REPORTER: If you could repeat, please.

MR. ANTHONY: Okay. Certainly.

The next item was open item 10.3-4 which was the alternate to Reg Guide 150. That's the minimum welding pre-heat temperatures.

What we ended up discussing with the NRC was using the post-weld baking which is in accordance with ASME 3, Appendix D, Article D1000, which requires us to minimum pre-heat temperatures and then do a post-weld baking that keeps the delayed hydrogen cracking from getting into the pipes from the welding.

The next open item -- Number 5 -- which is basically our last open item from 2007 was the material specs and grades for non-ASME systems susceptible to erosion corrosion. Since this plant is a 60-year life plant, basically Generic Letter 89-08 really didn't cover a 60-year plant. It really covered older plants based on the Surry event where feedwater pipe had some two-flow and broke open, basically destroyed the pipe and killed a few people.

So from the 89-08 letter, we used the design criteria that EPRI came up with basically out of CHECWORKS and some materials Emprasarios Agrupados has done for us to review the pipe configurations. We've used that plus we've used enhanced materials to get rid of or mitigate the deleterious effects of basically high-flow and piping systems.

We found that carbon steel will not be working for the feedwater system basically. So we had to go to a P22 material which is a carbon and Chrom-Moly material to upgrade the system and make it last 60 years. Plus we will still have in the COL action items, we will have the own looking at a long-term monitoring report to make sure that it meets the intent of the guidelines.

We had some other questions on chemistry excursions. Basically we're going back to the chemistry guidelines in the BWR VIPP 130 reports. And they also had a request from the NRC that the Main Condenser Evacuation System really didn't show up because GDC-64 requires monitoring of releases. We really hadn't discussed that system in the DCD. So they asked us in Chapter 12 to upgrade that.

Basically the vacuum pumps go to the turbine building system, less than five percent power since there's little or no radiation at that point, and then would go over to the steam jet air ejectors at above five percent power or when we count on main steam. And that gets the full evaluation up to the stack.

MEMBER ARMIJO: What kind of chemistry excursions did this deal with?

MR. ANTHONY: The original request on chemistry excursions was what level of purity are you going to keep in the water. So what we did was for the COL evaluation, we have a table that outlines five different levels of chemistry, level 1 being almost perfectly clean water. If you get to level 2, you have to bring it back to level 1 within a certain period of time. And we were looking at both resin intrusions and salt water or circ water intrusions into the condensate purification system. So any type of conductivity, any type of resin fines, any type of silica that's being bypassed on the resin beds.

MEMBER ARMIJO: So this is separate from any delivered chemistry controls?

MR. ANTHONY: Yes. We don't use any chemicals in the BWR. We use two gases -- oxygen and hydrogen.

MEMBER ARMIJO: Well, how about zinc?

MR. ANTHONY: Well, this plant's not built with zinc because we don't have a research system. So it doesn't really need it.

MEMBER ARMIJO: You don't need it.

MR. ANTHONY: They're going to evaluate that in the long run because reactor water clean-up does X the vessel, and it might be good for the

facility to choose a zinc system. But right now it's an option and not required for the system.

MEMBER ARMIJO: Okay. And an option also for the hydrogen?

MR. ANTHONY: Yes, it is. The hydrogen water chemistry system is an option. We believe we've selected proper materials from 30 years of experience that that is an option that you can build on. Plus noble chemistry is an option also.

MEMBER ARMIJO: Got it.

CHAIR CORRADINI: Go ahead.

MR. ANTHONY: I'd like to go to my summary then.

We believe that the ESBWR is a favorably-oriented turbine basically perpendicular to the reactor and single failure-proof digital trip system. And it also has a hard-wired back-up manual trips from the front standard and from the control room.

We use a mono-block turbine rotor and generator rotor. This is to increase safety. Basically we're at least one-fold greater than the regulation. We're at least 10^{-5} probability.

And we have main steam piping that is now code-stamped to ASME Code Class 2, and it'll be treated basically the same as the nuclear steam supply

system coming from the reactor.

Feedwater lines were upgraded to Chrom-Moly P22 piping. And we've added O_2 control for FAC basically between 50 and 100 parts per million to keep a surface on it.

The plant was designed really from basic lessons learned and operational experience from the rest of the plants in the fleet. And we used the contemporary materials and systems.

CHAIR CORRADINI: John?

MEMBER STETKAR: Yes. I'm sorry.

MR. ANTHONY: No problem at all.

MEMBER STETKAR: Too many meetings. Spin my head around so I can think about this.

Where is the turbine missile analysis, the overspeed analysis and so forth documented?

MR. ANTHONY: It's documented under a COL action item 10.2.

MEMBER STETKAR: So the actual analysis will not be done until the COLA when they --

MR. ANTHONY: It's not required to be done but the NRC found it was hard to evaluate Chapter 10 without it. So back in 2006, we agreed with the NRC we would generate a bounding report.

MEMBER STETKAR: Where is that report?

MR. ANTHONY: That bounding report was submitted to the NRC under a COL action item from Dominion, I believe. And it was presented right before I came here in November of 2007. You guys had just received a personal copy but you hadn't read it yet. It was probably only a month or so old in 2007.

We're in --

CHAIR CORRADINI: We can get it for you, John. I remember it. It's under North Ana.

MS. CUBBAGE: You can pursue that when Fermi comes in.

MEMBER STETKAR: Okay. Yes. As long as I know when to kind of think about --

MS. CUBBAGE: Yes. I think the Fermi COL presentations would be the opportunity to --

MEMBER STETKAR: Okay. Fine.

MS. CUBBAGE: -- comment on that.

MEMBER STETKAR: That's fine.

I don't care whether Fermi submits a different one or whether they just adopt the one that's there. It will come up during --

MS. CUBBAGE: I believe it's the same one. It's just being --

MEMBER STETKAR: Okay. But it will come up and be a topic under the COLA.

MS. CAMPBELL: This is Patricia Campbell from GEH.

Fermi -- can you hear me? Is it on?

CHAIR CORRADINI: It's on.

MEMBER STETKAR: As long as Charles can hear you. That's the important thing.

CHAIR CORRADINI: Can you hear her? Okay. go ahead.

MS. CAMPBELL: Okay. This is Patricia Campbell from GEH.

I know that Fermi had a request for additional information on that and will be submitting it if they have not already.

MS. CUBBAGE: Okay. Thanks.

MR. ANTHONY: The report's in revision right now. There are a couple of minor items that they wanted a little more detail on.

MEMBER STETKAR: Thank you.

CHAIR CORRADINI: Anything else, John?

MEMBER STETKAR: I'm looking rapidly through my notes here.

CHAIR CORRADINI: We can wait.

MEMBER STETKAR: Yes. Turbine bypass completely. I don't know whether you discussed anything about this. Again, I'm sorry.

MR. ANTHONY: No. But I can fully discuss anything you want. I've been dealing with this.

MEMBER STETKAR: That's a dangerous statement.

In the DCD, it says, "The time for bypass flow to achieve 80 percent of total capacity after the start of turbine stop-out closure or turbine control valve fast closure is less than or equal to 0.17 seconds." That means that not only do I need the signals, but I need the turbine bypass valves open far enough to achieve 80 percent of rated steam flow. And that's -- it's in the basis for tech spec surveillance requirement in the tech specs. So it's a pretty hard and fast number. It seems like a really smaller number.

Can you actually get turbine bypass valves open that quickly? I come from an old operating plant where we were lucky if they opened at all much less getting open to that amount of flow that quickly. You don't want them to open too far because that's not good either.

MR. MARQUINO: This is Wayne Marquino.

Yes, we can open them that fast. The Leibstadt plant is an example of full bypass capacity plant that has basically the same logic and

requirements.

MEMBER STETKAR: And they can actually get the value -- I mean, they have functional tests that show they can get the valves open, not just a signal to the valve that quickly?

MR. MARQUINO: Right.

MEMBER STETKAR: They actually get the valves open?

MR. MARQUINO: Right.

MEMBER STETKAR: Okay. Thanks. That's just surprising. It sounded like an awfully short time. And I was wondering why it needed to be that short.

MR. MARQUINO: Well, it's a tough requirement.

MEMBER STETKAR: It is.

MR. MARQUINO: But it's needed for plants that want to -- BWRs that want to avoid scram on load rejection.

MEMBER STETKAR: Yes.

MR. MARQUINO: And we have the requirement because if the RPS does not see the valves open in that amount of time, it scrams.

MEMBER STETKAR: Yes.

MR. MARQUINO: And we have a safety

evaluation that shows if nothing happens and we wait for 170 milliseconds, it's okay.

MEMBER STETKAR: Yes. It's the .2 second scram signal that comes in, right?

MR. MARQUINO: Yes.

MR. ANTHONY: And we actually have it plotted here on some graphs if the NRC ever wanted to audit us on it. It shows 100 percent reactor power and how the bypass valves take over the steam that was normally going down --

MEMBER STETKAR: I can understand how you can show that on a plot. I was just curious whether you can get actual valves in a plant to do this.

MR. ANTHONY: In sort of just the livestock, there's five or six --

MEMBER STETKAR: As long as you've got actual units out there that can do this.

MR. HAMON: This is Dave Hamon.

Livestock, when they did their power upgrade a few years ago actually went on a full-load reject test and proved that it worked.

MEMBER STETKAR: Okay.

MR. HAMON: And so we do have --

MEMBER STETKAR: Okay. Fine. Good. Thanks. Thanks.

I just wasn't aware that that was --

MR. ANTHONY: We have their digital signals they sent to us that we can model the program from.

MEMBER STETKAR: And one last question that I had. And this was kind of a holdover from a Subcommittee meeting where the --

CHAIR CORRADINI: This is a Subcommittee meeting.

MEMBER STETKAR: An earlier Subcommittee meeting. I'm sorry, Mr. Chairman. I was not precise enough.

The feedwater system has one low-flow control valve or two?

At the time I questioned you'd apparently made a design change at that time -- somewhere earlier in the part of the design evolution -- to install a low-flow control valve for start-up/shutdown operations. And said are you going to have one. And at that time, I was told well, the decision hasn't been made whether we're only going to have one or we're going to have two in parallel or something like that. Is it still only one?

MR. ANTHONY: The DCD leaves it open for us to have as many as we need to. It just has at

least one. At the present time we have one that's used for the condensate pumps on initial start up such that the condensate pumps can directly feed the reactor without the feedwater pumps.

When we go to feedwater pumps, two of the pumps at the present time have start-up control valves on them. So you have Feedwater A and B have start-up valves on them. C and D can sit in spare. We only need three out of the four pumps at 100 percent power. Either one of those feedwater pumps can assist us on the rest of the start-up.

MEMBER STETKAR: Is that described in the DCD that the control valves off the two main feed pumps?

MR. ANTHONY: There is a drawing in the feedpump in Chapter 10 that shows one of them. And there's a footnote underneath that says there may be others.

MEMBER STETKAR: Okay. I guess I missed that. I looked at Rev 7 of the DCD and it talked about one "low-flow control." That's okay. I can look it up.

MR. ANTHONY: We put some words in there to allow us to modify it as needed.

MEMBER STETKAR: Just Rev 7 or Rev 8 of

the DCD?

MR. ANTHONY: Just 7.

MEMBER STETKAR: Seven? Okay.

Thanks.

MR. ANTHONY: Certainly.

MEMBER STETKAR: And if you can find the drawing number quickly, I'd appreciate it. I'm capable of digging through drawings.

MR. ANTHONY: It should be in 10.4. That's where all the auxiliary systems are.

MEMBER STETKAR: Well, yes, except the Feedwater is in 10.1-1 is the only place that I could find any decent drawing of the feedwater system.

CHAIR CORRADINI: We can get back to it.

MR. ANTHONY: Okay.

MEMBER STETKAR: Yes, that's fine.

CHAIR CORRADINI: Any other questions?

MEMBER ARMIJO: I had a couple questions.

CHAIR CORRADINI: Go ahead.

MEMBER ARMIJO: The feedwater uses Chrom-Moly piping and oxygen control. How far back does that material and oxygen control go in the feedwater system? Do they go right all the way through back into the feedwater heaters?

MR. ANTHONY: Yes. Actually what we do is

they come out of the condenser de-aerated.

MEMBER ARMIJO: Okay.

MR. ANTHONY: It goes to the condensate pumps so basically we don't have any oxygen or air in there. We start adding air at the discharge of the condensate pumps. So we control oxygen from the discharge of the condensate pumps only a little bit because we don't want to oxidize the resins in the condensate purification system. After that, we fill in the rest of the air and that goes to the de-aerated tank number four. We start losing oxygen there because we have de-aeration open feedwater heater tank there.

We add oxygen again at the discharge of that tank going to the feedwater booster pumps to ensure that we have 50 to 100 parts per billion of oxygen going all the way to the reactor.

MEMBER ARMIJO: Okay. And so your feedwater heatings are the same? Are they Chrom-Moly water heaters or are they --

MR. ANTHONY: In the DCD, we discuss the use of Chrom-Moly on areas that need protection> Where the pipe or the feedwater heaters are large, they don't have the flow erosion controls. We basically use stainless steel tubes in them. And the

shells are carbon steel because there's no flow accelerating corrosion.

MEMBER ARMIJO: But you don't have -- through those tubes?

MR. ANTHONY: No. It's basically stainless in them. We use stainless and P22 where we need to.

MEMBER ARMIJO: Thanks.

MR. ANTHONY: The Figure 10.1-1 on Rev 7 DCD page 10.1-7, lower left-hand corner, discusses typical as required for start-up pumps. So basically it allows us to install those low-flow start-up valves for as many pumps as the client wants to buy them. But a minimum of one.

MEMBER STETKAR: You were probably citing things from --

MR. ANTHONY: Well, that's fine.

CHAIR CORRADINI: 10.1-1.

MR. ANTHONY: 10.1-1.

MEMBER STETKAR: 10-1.1. Thank you.

MR. ANTHONY: Lower left-hand corner.

MEMBER STETKAR: I'll find it. Thank you.

MR. ANTHONY: Yes.

MEMBER ABDEL-KHALIK: I'd like to comment you on that level of detail and specificity in this

chapter. I wish we had the same level of detail and specificity in Chapter 7.

MR. ANTHONY: Thank you. I wrote this one.

(Laughter.)

MEMBER ABDEL-KHALIK: Good for you.

MR. ANTHONY: I didn't really write 7.

CHAIR CORRADINI: We figured you didn't.

All right. Other questions for Mr. Anthony?

(No audible response.)

CHAIR CORRADINI: Hearing none, we'll have the staff join us.

Thank you very much.

MR. ANTHONY: Yes.

CHAIR CORRADINI: Leslie, you're up?

MS. PERKINS: Yes.

CHAIR CORRADINI: Okay. And helpers. Colleagues. Excuse me.

MS. PERKINS: Leslie, are you going to start us off?

MS. PERKINS: Yes.

CHAIR CORRADINI: Okay. Go ahead.

MS. PERKINS: My name's Leslie Perkins. And I'm the PM for Chapter 10, Steam and Power

Conversion.

And before I get started, I just want to highlight a couple of typos in the slides. Slide 3 for RAI 10.3-6 should say non-ASME code. And there's a typo in slide 6. It should say open item. So just to make you aware of those changes.

Today we have with us the technical staff, Devender Reddy from Plant Branch and Bob Davis from Component and Integrity Branch.

We briefed the Subcommittee on Chapter 10 back on November 15, 2007. The presentation was based on Revision 3. There was roughly four open items at that time. Today the staff is going to focus their discussion on the two open items that they consider more significant.

We're going to discuss the resolution of RAI-10.2-18 which dealt with electronic-only turbine overspeed trip system. And then we're also going to discuss the resolution of RAI 10.3-6 which discusses mitigating flow accelerated corrosion and non-ASME Code condensate and feedwater systems.

And at this time, I'll turn it over to Devender to discuss RAI 10-2.

MR. REDDY: Thanks, Leslie.

As Leslie said, I'm Devender Reddy. I'm

from -- Plant Branch. And for this presentation is regarding the turbine system and the close-out of items which Leslie identified. That is 10.2-18.

In fact, this open item was closed in 2007 ACRS meeting was the time it was closed. But let me give you some background of why we again are talking about this.

Previously, this from the plant operating experience the NRC, it showed series of RAIs with respect to turbine missile generation and turbine overspeed control systems. The staff was concerned about turbine missile generation due to the overspeed and its consequences on the safety-related SSCs. Also the staff was concerned about the redundancy and the diversity factors of the turbine control systems and to confirm to the SRP Section 10.2. And ESBWR deviated from these RP guidelines and it -- one of the mechanical and electric control systems, they have two electrical systems.

And the staff assured based on that QRS, GEH that -- and based on the review of the responses, the staff considered -- about the response was acceptable and the open item was closed at that time.

However, later on based on some of ACRS comments on previous DCD's -- I'll name some of them

in Dr. Sayed and Dr. Stetkar -- you raised some issues on the turbine generator control systems and the redundancy factors of the whole system. So based on that, really we re-opened that and reissued several RAIs. And then the RAIs were -- for the primary and emergency overspeed systems and the hydraulic and air systems which Dr. Stetkar raised quite a bit on a few of the ACRS meetings.

MS. PERKINS: Which slide on?

MR. REDDY: The second one? This one. Go back.

So when we revisited the DCD, we focused on the turbine missile vulnerabilities and their impact on the Category B -- equipment. And also, as I said, the -- criteria and the diversity and the redundancy conservations in the entire turbine system. That includes the valves, upstream valves and extraction monitoring valves and the -- system I&C and then the hydraulic system. And of course, the GEH, they responded. And we evaluated those and found that their responses were acceptable.

And the conclusions were like this. The turbine orientation and the effects of the low trajectory missiles on RTNSS Category B SSCs. Actually we found that there is no weakness Category B

equipment in the turbine building.

And the second thing is level of diversity. As an example, the hydraulic system, they have the -- equipment and from the turbine -- to the hydraulic -- they were -- lines.

So there was enough redundancy while establishing that. Same is the case of the control systems from the sensors to the thermal block. And also the non -- valves, they're redundant in the inspection lines.

So based on our review of the responses provided by General Electric and Hitachi, we found that the ESBWR system is acceptable.

Go on to the next one.

So in conclusion, the staff concluded that the safety-related SSCs in the turbine building are fail-safe and no RTNSS -- in the turbine building, and redundancy and diversity in the turbine overspeed protection system is adequate. Therefore the staff found that the turbine generator of the ESBWR design is satisfactory.

And no more open items except what is Bob is going to talk about.

Any questions, please?

(No audible response.)

MR. DAVIS: My name is Bob Davis. And I'm the lead reviewer for 10.3-6 which is Class II steam and feedwater materials.

We had one open item for 10.3-6 because in 10.3-6 we talk about the FAC program, and the FAC is predominantly a problem in non-ASME Code piping. So we asked a question about the non-ASME Code piping since that's really a very big concern and recently in Japan here a few years ago, that would be non-Code piping in a U.S. plant.

We asked GE to explain the materials that they were going to use in the non-ASME Code Section 3 systems. And they indicated that those systems had not been designed yet. So we requested them to provide a COL applicant item to provide the information for the condensate and feedwater system which is actually described in Section 10.4-7 of the DCD.

GE agreed to change Section 10.4-7 to state that these systems are susceptible to FAC -- they're designed for 60 years -- and that the operating experience and recommendations from Generic Letter 89-08 and NUREG-1344 are applied to design and operation and that when required by analysis during design, FAC-resistant materials will be utilized.

And again I want to stress that these systems are not safety-related systems.

So we accepted their change to the DCD that they would commit to ensuring that the materials that they select would last for 60 years. And based on that, we closed this open item.

MEMBER ABDEL-KHALIK: Are there any questions for the staff?

(No audible response.)

MEMBER ABDEL-KHALIK: If none, we'll move on to the next Chapter.

MS. CUBBAGE: I'd like to just interject for a moment. I see that Mike has stepped out.

What we did want to revisit since we're a little bit ahead of schedule -- revisit a couple of the items from this morning.

MEMBER ABDEL-KHALIK: Yes.

MS. CUBBAGE: First would be the diurnal-swing issue. We have a couple of slides that Chris was going to try and get on the computer for us. He's doing that right now. Okay.

And while we're waiting on that, perhaps, Wayne, would you like to speak to the decay-heat issue from yesterday?

MR. MARQUINO: Yes. We also had some

information we want to get on the computer -- a table of the decay-heat values that were used in the spent fuel pool analysis. I don't know if that will be possible. I emailed that to Chris.

MS. CUBBAGE: Chris disappeared and his thumbdrive is there. So I don't know if they're on it or not. So I apologize. When I planned to switch to these topics and I looked up and they were both gone. We need Chris.

MEMBER RYAN: Mr. Anthony made a comment as we were just getting started on the underground piping that I think would be a benefit to the rest of the Subcommittee --

MS. CUBBAGE: Okay. Sure. Is he --

MEMBER RYAN: -- maybe repeat that. I think he was just leaving.

If I could ask you to repeat some of the comments you made regarding the underground piping design and construction approach that you mentioned to me to the rest of the Subcommittee, that might be of benefit.

So the question was is there any underground piping and how is it going to be built and monitored?

MR. ANTHONY: Basically, myself being ex-

rad waste engineer and my cohort Jim Cascone, when we took a look at the way the ESBWR was being built, we decided to eliminate any possible chances that we would get into trouble like Vermont Yankee and some of our brother and older plants. So all pipes and rad waste are basically above ground in open areas that we can visually inspect in tunnels.

The only one pipe that we have leaving the ESBWR plant that has potentially contaminated liquids is our effluent pipe that leads from rad waste and goes to the circ water system. That'll have a sleeve on the outside that'll be either a PVC or a fiberglass pipe because we don't want that being attacked by the ground. That's why we use the non-metallic-type. The inner pipes are stainless steel.

CHAIR CORRADINI: So it's the outer pipe.

So this is different that North Anna planning that we had heard about about piping?

MR. ANTHONY: -- was allowed to select the actual materials. They requested us what we would build for them.

CHAIR CORRADINI: Okay.

MR. ANTHONY: Basically you take a look at the type of ground that it's going to be placed and then you pick a material for the guard pipe that would

not be attacked. The guard pipe will have testing capabilities at either end. And so will the inner pipe have a testing capability at either end sort of like an LLRT system.

And we have samples that are collected at either end so you'd know whether it was groundwater intruding or radioactive water coming out of the pipe. And you just take the vial and you take it over the counter and you see if it's radioactive or it has materials in it like salt water or --

MEMBER ARMIJO: Would there be joints on the PVC guard pipe that is sort of equivalent to welded joints or flange joints or anything like that?

MR. ANTHONY: It depends on the material of the pipe itself. There's always going to be joints because some of these things can be 100 yards long in pieces.

But basically if it's fiberglass pipe, you would have a resin sealing system that the two sleeves are put into like you do at home except it's a resin for a fiberglass pipe.

And the ADS pipe that we recommended is basically a hot welded joint that's sort of like hot glue. It seals it together. And the pipe -- the stainless pipe down the middle would be built with

Schedule 20 stainless steel welded ends. We don't have any crevasses.

CHAIR CORRADINI: Any questions for Mr. Anthony?

(No audible response.)

CHAIR CORRADINI: Okay. So we're back to what bulb temperatures?

MEMBER RYAN: For decay-heat.

CHAIR CORRADINI: For decay heat. Excuse me. Or?

MS. CAMPBELL: I think Wayne is making the call to get these. So he should be back.

CHAIR CORRADINI: We're waiting for Wayne. You can put that in the record or not.

MS. CUBBAGE: We'll go to this one now. And then you have something else --

MR. BROWN: Okay. I need to retrieve something else he's sending me. Okay.

CHAIR CORRADINI: Amy, this you want to talk about first?

MS. CUBBAGE: Yes. Go on up, Brad. Brad Harvey will be coming back up from earlier.

CHAIR CORRADINI: Okay. Excuse me. Okay. Thank you. I had -- in my head. Sorry.

MS. CUBBAGE: We're going to make another

attempt at the figures here.

CHAIR CORRADINI: Give it a whirl, Brad.

MR. HARVEY: Okay. Brad Harvey with the staff, meteorological reviewer for Chapter 2.0 of the DCD.

This is the slide from slide 10 of my earlier presentation. And while I played with it a little bit, what I've gotten now here on the dotted red line is the wet bulb globe temperature calculated hourly. That's a function of the dry bulb temperature and the wet bulb temperatures which are measured values. And the wet bulb global temperature happens to be a calculated value again.

And so what I've done next --

CHAIR CORRADINI: Before we --

MR. HARVEY: Go ahead.

CHAIR CORRADINI: Before you add to the red, so blue is the measured dry bulb. Green is the measured wet bulb and red is the computation of the global --

MR. HARVEY: Yes. The wet bulb global --

CHAIR CORRADINI: I'm sorry. Global wet bulb temperature. Excuse me.

MEMBER ARMIJO: Using that average that you have on that --

MEMBER STETKAR: No. Using .3 times the dry bulb.

MEMBER ARMIJO: Sort of the equation.

MEMBER STETKAR: Well, it's .7 times the dry bulb plus .3 times --

CHAIR CORRADINI: You said it backwards.

MEMBER STETKAR: I said it backwards.

.3 times the dry bulb plus .7 times the wet bulb.

MEMBER ARMIJO: Okay.

MEMBER STETKAR: That's the red line. It's not actually the average --

MR. HARVEY: Correct.

CHAIR CORRADINI: It is not --

CHAIR CORRADINI: No, it's just one.

MR. HARVEY: It's a calculated index.

CONSULTANT WALLIS: Before you leave this, the three curves have the same minima everywhere except that 58 one. And the 58 one is the problematic one because it's a flat minimum and you can choose anywhere along there where you want to make your choice. And if you choose the beginning, which is the minimum weighted --

CHAIR CORRADINI: Now be careful, Graham. All he did -- he's not gotten to max HH average --

CONSULTANT WALLIS: But I'm just saying that the utility has a choice about where to be along that flat minimum. And they can get different numbers depending on where they want to be. But that's the issue we have this morning.

And I notice that the red curve does have a clear minimum at one place there. And all the other ones, the minima are all coincidences. There's no ambivalence. But there there's a real ambivalence about where you should take the minimum of the green curve. It makes quite a big difference to the number you calculate.

CHAIR CORRADINI: Okay.

CONSULTANT WALLIS: Because your blue curve is very different at different minima.

MR. HARVEY: Yes, yes. The blue curve is more responsive. And the green curve ends to be a more flatter curve.

CONSULTANT WALLIS: So if the utility wants to be optimistic or pessimistic, they can choose different numbers anywhere between 65 and 80 for the blue curve.

CHAIR CORRADINI: Okay. But you had something more to tell us.

CONSULTANT WALLIS: No, he was going to

move on. He seemed as though he was going to move on. So I wanted to keep him here.

MR. HARVEY: No, it's a valid point.

CONSULTANT WALLIS: Right.

MR. HARVEY: What I'm trying to do is reproduce what my understanding is of what the DCD tells the COL applicants to do.

CONSULTANT WALLIS: Okay.

MEMBER STETKAR: But Brad?

MR. HARVEY: Yes?

MEMBER STETKAR: Are you going to move to the -- I'll let you finish. Go on. You're on a roll.

Well, we might come back. But --

MR. HARVEY: Okay. All right.

So what I've done is I removed the blue lines and the green lines. All we're looking at is the wet bulb globe temperature here. Okay?

And the solid red line is the calculated value of the 72 that we talked about this morning. And so the intent I was just trying to show here is that if you take -- what we're looking for is the 72-hour value because we're assuming loss of power -- passive cooling in the control room for 72 hours. And the vertical bars are a 24-hour period.

So the intent here is to show that at

least for the way I did it -- shows that I think generally for a 72-hour average, we're going to be below the 72 degrees Fahrenheit that we calculated for the wet bulb globe temperature.

CONSULTANT WALLIS: Well, that's just for this particular example.

MR. HARVEY: For this particular example.

MEMBER STETKAR: But Brad, now go back to the earlier one.

I think the concern -- at least my concern is the selection of the points that you use to calculate that maximum average wet bulb globe temperature index value.

MR. HARVEY: Okay.

MEMBER STETKAR: For example, instead of selecting the two points that you selected, if I select -- if I can call the first vertical line midnight on day one -- beginning of day one -- if I select those points where the dry bulb temperature is about 74 and the wet bulb temperature is about 70, and I select the points of probably about 2:00 or 3:00 o'clock in the afternoon on day three where the dry bulb temperature is about 102 or 103 and the wet bulb temperature is about 74 -- if I select those two points and do the same averaging, I get a value of

76.95 degrees, not 72.1. And the question is why don't I do that?

MR. HARVEY: Well, the direction is number one, you're picking the 100 percent -- there's zero percent exceedance wet bulb temperature. That's the 75.

MEMBER STETKAR: Right.

MR. HARVEY: That's a given.

Now what you're doing is you're looking at the three diurnal cycles on either side of that and you're picking the daily low wet bulb temperature for those.

CHAIR CORRADINI: Can you repeat the first part that I want to understand? You pick 75 why?

MR. HARVEY: This is the zero percent exceedance wet bulb temperature.

CHAIR CORRADINI: Okay. Fine.

MR. HARVEY: It's the highest wet bulb temperature you measured during the last 30 years.

CONSULTANT WALLIS: That's clear.

MR. HARVEY: Okay.

CONSULTANT WALLIS: We know what that is.

MR. HARVEY: Okay. All right.

Now these dots are intended to be the daily low wet bulb temperature.

CONSULTANT WALLIS: But that 75.8 is --

MR. HARVEY: Yes. But you would never be down here because now you're bumping --

CONSULTANT WALLIS: But you can choose a lot of different 58s along that -- there's --

MR. HARVEY: Okay. But if you're down here, now 56 becomes your bounding, not your 58 because now this would be the highest of the three.

CONSULTANT WALLIS: No, I'm more concerned about 58 being okay. But if I move along that curve, I can do --

MR. HARVEY: But now you're not low. You're looking for the --

CONSULTANT WALLIS: Just the whole variety of the blue points --

CHAIR CORRADINI: No, but he's telling you --

CONSULTANT WALLIS: That 75 is very arbitrary up there above there.

CHAIR CORRADINI: But you got to listen to what he just said. He said you start with 75 in the green line.

MR. HARVEY: That's your high.

CHAIR CORRADINI: And you look for the lowest daily one.

MS. CUBBAGE: The highest low.

CONSULTANT WALLIS: The highest of the lows.

MR. HARVEY: Now you want to look for the daily lows.

CONSULTANT WALLIS: I understand. We were talking about the daily lows. Now we're talking about the 58.

MR. HARVEY: Wait. This is not a daily low up here, right?

CONSULTANT WALLIS: I'm not talking about that. I'm saying 58 is a very flat --

MR. HARVEY: You're correct.

CONSULTANT WALLIS: So that that 78 --

MR. HARVEY: You want to take this number down.

CONSULTANT WALLIS: No, I don't. I said that 75 on the blue curve.

I could easily take another one of those wiggles there on the 58 and get a whole lot of different numbers on the blue curve above it because that's where the biggest swing I can get off.

CHAIR CORRADINI: But I think, Graham, unless -- I want you to repeat what you said. You start with 75 on the green curve because that's the

highest historical --

CONSULTANT WALLIS: Fine.

CHAIR CORRADINI: -- wet bulb. And then the next step is you look for the -- again, can you repeat it? I'll say it wrong.

MR. HARVEY: The intent is to do the three daily low wet bulbs.

CONSULTANT WALLIS: But the coincident DB of 75 is what I'm quibbling about. I think with that minimum you could be anywhere from 65 to 80.

MR. HARVEY: You'd be anywhere along this curve.

CONSULTANT WALLIS: No. On the blue curve.

MS. CUBBAGE: That in fact would be this many --

CONSULTANT WALLIS: You'd be anywhere on that blue curve up there.

MR. HARVEY: Yes, but what you're calculating -- what you care about is the red line.

CONSULTANT WALLIS: Okay. So anywhere along that red curve. Yes.

MR. HARVEY: Yes.

CONSULTANT WALLIS: Because anywhere depending upon which wiggles you wanted to choose for

the 58.

PARTICIPANT: Which is a five degree --

CONSULTANT WALLIS: It's quite a big difference.

MEMBER STETKAR: Brad?

MR. HARVEY: Yes.

MEMBER STETKAR: Is this -- I don't know anything about this stuff. Is this methodology a standard methodology for calculating this index? Or is it your proposed methodology?

CHAIR CORRADINI: GEH's.

MEMBER STETKAR: GEH's proposed methodology?

MR. HARVEY: The index I think is standard.

CHAIR CORRADINI: Well, the .3, .7 is the standard. But I mean, this construct of calculating t his now average temperature that we use for the 72-hour period. What is the genesis of that average calculation?

MR. HARVEY: I think -- and then I'd have to look for GEH -- and again, our Chapter 6 people may be able to help you. But I think the intent is you're picking your worse case wet bulb -- okay -- and then you're trying to calculate a diurnal range and

deciding what that diurnal range is.

So I think the input to the computer program is the maximum temperature and then a diurnal range just so --

MEMBER STETKAR: Yes, I understood before how they did that.

MR. HARVEY: All right.

MEMBER STETKAR: The diurnal range was relatively small. And the max -- I got before -- and I understood how I could figure that out from these things.

What I'm still flailing about a bit is what the averaging process does to me and what is the technical basis for those specific criteria.

I understand selecting the highest wet bulb temperature. I got that.

MR. HARVEY: Okay.

MEMBER STETKAR: The other part though is the highest of the three daily low wet bulb temperatures --

CHAIR CORRADINI: And the coincident --

MEMBER STETKAR: -- and the coincident dry bulb temperature. Why don't I select over a 72-hour period the 72-hour period that gives me the maximum average, if you will, of the index which in my little

calculations here would be 77 degrees, not 72 degrees, if I calculate the maximum average.

But it's sort of a philosophical issue, and I don't know what the technical basis for this is.

CHAIR CORRADINI: So the second line that John's asking -- highest of three daily low wet bulbs -- is that standard or is that ad hoc?

MR. HARVEY: This is GE's criteria.

MEMBER STETKAR: Okay.

MR. HARVEY: And what I'm trying to do is understand it so when a COL applicant comes in -- right? We did several iterations with them to get to this point. But quite honestly, they're the ones that are using the data.

MEMBER STETKAR: So we should be asking them what's the basis for this?

MR. MARQUINO: It's ad hoc. We haven't located any other application that define this. So we didn't have any guidance to define what the criteria is.

Now we have our analysis. So we started with an analysis basis on high temperature -- high dry bulb temperature. And then it was pointed out to us that we hadn't covered unit conditions which affect people versus equipment. And we added a unit

condition analysis.

And after defining that analysis, we had to characterize it in one or two numbers so that a site-specific confirmation could be performed. And that part is ad hoc.

I don't know of any other standard that we can go to. But if there's something that would fit our analysis, we'd be happy to apply that.

CHAIR CORRADINI: Well, don't agree to anything I haven't -- don't do anything on the fly.

MR. MARQUINO: As long as it's not excessively conservative.

CHAIR CORRADINI: Well, I guess what I wanted to ask is so we at least are clear that the second line -- highest of three daily lows -- is ad hoc based on your thinking about it and no historical precedent.

Then I want to understand the 72. The 72 then is used over the full three days with a variation --

MEMBER STETKAR: It's a specification that says that you should not have -- I mean, it feeds into that table that Amy showed us earlier that says the site has to characterize themselves as not having a --

CHAIR CORRADINI: No, but they use this as

one of their cases.

MR. MARQUINO: The case is actually 86.-something.

MR. HARVEY: 86.6.

MR. MARQUINO: And then, you asked if our analysis was not 86, it was 73, then how does it line up to this weather data.

MS. CUBBAGE: Right. So let me make sure I understand Brad.

What you're showing up top that number 72 is what the result is for this example.

MR. HARVEY: Exactly.

MS. CUBBAGE: It's not the acceptance criteria.

MEMBER STETKAR: No. But the acceptance criterium is 86.6. And that was calculated through some formula that we'll see in Appendix 3H apparently using this basic philosophy, I guess.

How is the 86.6 calculated? And certainly --

MR. MARQUINO: All right. How did we come up with 86.6?

MEMBER STETKAR: Yes.

MR. MARQUINO: We looked at met data. We were keyed in by a DoD report that identified 1986 as

a year of high wet bulb global temperature and identified isotherms of wet bulb global temperature. And based on that, we looked at Corpus Christi, Texas and got data for that.

And Antonio, I believe you're on the phone. Can you add to that?

MR. BARRETT: Yes. This is Antonio Barrett, GEH.

So the zero percent exceedance wet bulb temperature for potential sites hasn't changed for the ESBWR. It's still 88 degree wet bulb temperature.

MR. MARQUINO: Right.

MR. BARRETT: And so that's still in the Table 2.0-1.

MR. MARQUINO: Right.

MR. BARRETT: And so we started with that number. And as Wayne was pointing out, we looked at a bunch of different potential sites and non-potential sites. And what we did was is we came to a location that has extremely high wet bulb temperatures and dry bulb temperatures. And we identified a location -- I think it was actually Pensacola, Florida -- that had conditions that bound all the potential ESBWR sites.

We then took that met data, found the location and year where we had the extreme conditions

where we had an 88 degree wet bulb temperature and then applied the methodology that Brad applied to his example. And that's how we came up with the 86 degree temperature -- wet bulb globe temperature value.

CHAIR CORRADINI: So --

MEMBER STETKAR: So let me ask a quick one before Mike asks his.

That backs away then from any of the connotation of that 8 degree variability. Is that right, Antonio? I mean, it preserves the 88 degree peak wet bulb temperature.

MR. BARRETT: That's correct.

MEMBER STETKAR: But you back away from limiting the diurnal swing to 8 degrees. You're allowing a larger diurnal swing, and therefore allowing --

MS. CUBBAGE: No, I don't --

MR. BARRETT: It would be a smaller diurnal swing because that's more limiting. So we start with the 88 wet bulb and its coincident dry bulb which is higher than the 88, and then we go down 8 degrees which is a small swing which is more conservative for the calculation.

MEMBER STETKAR: Okay.

CHAIR CORRADINI: But I think the figure

we have in front of us is confounding me at least because it's just some example. The example you used to get your 88 is what you just said using this methodology.

MS. CUBBAGE: Right. This is an example.

MR. BARRETT: Right. That's correct. So -- right.

So we did some cases. And then to confirm our methodology and to see if the staff could reproduce. My understanding is that Brad then went through some of his own cases. And this is one of the examples that he was choosing to show you guys.

CONSULTANT WALLIS: My own example is what a utility might have to do in order to see if they meet the criteria is an example --

CHAIR CORRADINI: But I guess I don't see anything --

MS. CUBBAGE: In this case, he came out with a 72 which --

CONSULTANT WALLIS: But what we're saying is by the way in which they choose things, they can change that number in an arbitrary way.

CHAIR CORRADINI: Well, be careful. I don't think I agree with that.

CONSULTANT WALLIS: Oh, yes.

MR. BARRETT: Okay. One thing that Brad has done on this particular slide -- I think we're looking at the same slide. There's also a red line which showed the wet bulb globe temperature index. And if you average throughout for every hour over 72 hours the wet bulb globe temperature which is the combination of dry bulb temperature and wet bulb temperature which is a reading of the humid conditions, you'll see that you get a temperature of like 66 degrees which is less than 72. So even if you pick a different value, you'll still be below the criteria.

So I guess our point is is that the way that we're coming up with this value, you -- okay, I guess --

MS. CUBBAGE: It's conservative.

MEMBER STETKAR: Well, it's -- no. It's a number. Don't use the word conservative. It's simply a number.

MR. BARRETT: Right.

MEMBER STETKAR: No, it's a number.

MR. BARRETT: So the one number, if you average all of the wet bulb globe temperature value for every single hour over that 72-hour period, you'll get a number that's lower than the number that you

would get you use --

CONSULTANT WALLIS: But we can push the red curve up without changing the numbers in the formula until we get a higher average.

MEMBER STETKAR: No, you can't. No, you can't.

The red curve -- the red-dotted curve is indeed the hourly wet bulb global temperature index.

CONSULTANT WALLIS: No, but what I'm saying is it could be --

MEMBER STETKAR: And that can't be moved.

CONSULTANT WALLIS: -- on day three, that could be -- the data could be higher without changing the numbers in the formula in which case the average would be higher. So you can't just say the average for this example --

MEMBER STETKAR: No, no, no. The average I think that Antonio was talking about is the real average but taken on our -- the 60 -- what was the number, Antonio? Sixty-seven degrees?

CONSULTANT WALLIS: Of these data --

MEMBER STETKAR: Right. But that's how he got the 88, Graham. That's the point. This data is not what he used. This is just an example of the methodology. The methodology he used was at the

Pensacola, Florida site.

MS. CUBBAGE: So I think I just want to make one point, and I think it's just to reiterate what Antonio was saying.

The methodology that we just discussed would have told you that the average was 72. But in fact, if you take all the real data, you get about 66.

CONSULTANT WALLIS: But this doesn't convince me at all because the real data could have been higher on day three --

MS. CUBBAGE: This is the real data.

CONSULTANT WALLIS: -- without changing any of those.

MR. BARRETT: The real data could not have been higher. That red line cannot have been higher.

CONSULTANT WALLIS: Of course it could.

MR. BARRETT: That is the actual data.

CONSULTANT WALLIS: You have a different pile of data. But in numbers --

CHAIR CORRADINI: Graham, that's irrelevant to the --

CONSULTANT WALLIS: Of course it's not irrelevant.

CHAIR CORRADINI: No. All I thought Antonio was saying was for a given set of data, the

dashed red line is an accepted norm.

CONSULTANT WALLIS: For another set of data with the same numbers on it -- the same 75 and so on. The red line could have been higher in between.

CHAIR CORRADINI: Sure.

CONSULTANT WALLIS: You get a different average.

CHAIR CORRADINI: Sure.

CONSULTANT WALLIS: And it's no longer necessarily conservative.

CHAIR CORRADINI: Well, their point is if their new set of data for a new site exceeds their 88 and 86, then that site's going to have to take exception and do a different analysis. That's my interpretation.

CONSULTANT WALLIS: I understand that.

CHAIR CORRADINI: Okay.

MEMBER STETKAR: My question is -- and I hate the word conservative because it gets thrown around an awful lot. I understand how taking the dotted red line as the actual wet bulb global temperature index value and averaging it over that 72-hour period gives me 67 degrees. I understand how that's done.

The arbitrary selection of points that are

used to calculate the arbitrary value of 72.1 degrees that is being characterized as a conservative approximation is simply an arbitrary selection of points. Because I can arbitrarily select two other points -- those being midnight of the first day and about 2:30 in the afternoon of the third day -- do the same calculation and come up with 76.95 degrees, which is also conservative compared to 67. And in fact, it can't get any higher than that. That is indeed the most conservative value that I can arbitrarily calculate for that 72-hour period given that red line if I want to take two points and average between them.

MS. CUBBAGE: Which two thing?

MEMBER STETKAR: Pick --

MR. BARRETT: This is Antonio Barrett from GE.

That's all true. But when we set out, what we wanted to do was get something that's more realistic -- something that's not overly conservative. I mean, what we could do is do 100 degrees at 100 percent humidity also. And that would be more conservative.

So what we wanted to do was we wanted to go back and look at actual data where you have actual swings, you have different highs, you have different

lows. And so the analysis was not conservatively at high temperatures for three days. So that's why we picked a three-day period. And then we wanted to pick something that was conservative but still representative of actual data. That's why we've chosen the highest of the day we load for a three-day period.

So it's arbitrary. I wouldn't say that's it arbitrary. But it's supposed to be a conservative representation of actual met data, not just an all-out conservative representation.

MEMBER ABDEL-KHALIK: Let me just ask a simple question.

If a utility has access to this data -- right -- in an hourly form -- both the wet bulb and dry bulb -- how difficult is it for them to generate their dotted curve and just use it? Are you sure that the maximum value -- the zero percent -- doesn't go above 86.6? Why are we arguing about this?

MR. MARQUINO: GEH, Marquino.

Going back 15 years, it's not difficult. If you go back later -- longer in time than that, you may have trouble getting hourly data. But I'm not sure that problem is relevant with the criteria that the staff is applying to us anyway.

CHAIR CORRADINI: What I think I heard you just say is that this is a non-issue.

MEMBER STETKAR: Well, it is an issue because you have it characterized as a zero percent exceedance which means it ain't ever going to get worse than this. So your sampling period over which you can actually --

MS. CUBBAGE: Wait a second. It's the zero percent exceedance high, and then the average temperature for that day. Not the zero exceedance average day.

MEMBER STETKAR: Okay. That's right. I'm sorry. You're right. You're right. It's not -- yes.

MS. CUBBAGE: It makes a difference.

CONSULTANT WALLIS: Well, it's only a non-issue if they use the incomplete average. If they're going to use this mysterious formula, then --

CHAIR CORRADINI: But if they use a mysterious formula, it's higher than the average.

CONSULTANT WALLIS: Not always. Not always.

MEMBER STETKAR: It doesn't necessarily have to be, Mike. If they used a different formula with the two peaks that I had --

CHAIR CORRADINI: If we stipulate say his

approach, if I were a betting man, I would bet than most of the time it would be at or below what we're seeing here.

CONSULTANT WALLIS: Not necessarily because you're averaging --

MEMBER STETKAR: If you have the data.

CHAIR CORRADINI: If you have the data.

MEMBER ARMIJO: But if you have to do it over a longer time period where you don't have that data, then you've got to do something else.

CHAIR CORRADINI: But beyond 15 years ago, they're not going to have an hourly thing. They're going to have a number.

MR. HARVEY: That's been a non-issue. I already have --

CHAIR CORRADINI: Okay. Fine.

MEMBER STETKAR: Hourly data is available.

MR. HARVEY: Originally, that was my suggestion. But the applicant told me that I guess the input to their heat-up analysis is the zero percent exceeds temperature in a diurnal range which to them is different than an average value for 72 hours. And we had a bit of a discussion with the applicant over time. And this is why it ended up the way it did.

MEMBER STETKAR: These are the criteria by which an applicant will demonstrate that they are within the calculational limits. Why go through this stuff if they can generate this dotted graph and show that it never goes above 86.6?

CONSULTANT WALLIS: On the average.

MEMBER STETKAR: Ever.

CONSULTANT WALLIS: Ever.

MR. HARVEY: Well, it might. And again, it's three-day --

MEMBER STETKAR: In the period that you have the peak.

MS. CUBBAGE: It's a difficult problem obviously. Coming out of the technical review of the system, we ended up with this diurnal swing and it's a little wacky. And so the analysis is based on a diurnal swing.

We had concerns about being able to be able to cite this for the majority of applicants to have to meet the daily high and the diurnal swing as two separate things. So this is what we came up with, or I should say the applicant came up with. And we agreed it was reasonable and that approach would be adequate to verify that the analysis was acceptable.

CHAIR CORRADINI: Okay. Shall we move on?

Wayne? Thank you. Are you ready to have fun with the decay-heat?

MR. MARQUINO: If possible, I'd like to do that after the next break so that I have time to do something on the computer.

CHAIR CORRADINI: We will give you that time.

MR. MARQUINO: Okay.

CHAIR CORRADINI: So we're back now to Chapter 14, Test Program and ITAAC. but not ITAAC the way the committee would like to talk about it. This is normal ITAAC.

Mr. Anthony and Ms. Campbell? Oh, and I'm sorry. And of course, Wayne.

MS. CAMPBELL: I'm Patricia Campbell from Reg Affairs. And with me is Wayne Marquino and Gary Anthony who've you heard from today already from Engineering.

Chapter 14 is entitled Verification Programs. It describes the test inspections and verifications that will be performed to ensure that the plant has been constructed as designed and licensed and to demonstrate that the systems function properly.

The ACRS has previously reviewed the

information in Chapter 14 back in October 2008. As noted on the slide, at that time there were five open items in Section 14.2 and approximately 78 open items in Section 14.3. These open items have been resolved as described in the current Advanced SER either in Revision 6 or 7 or in subsequent action items that will be in Rev 8.

For today's presentation, we have coordinated with the NRC staff and will cover three examples of the resolution of these items. So the same examples that we cover, they will cover in their presentation.

As described in Section 14.2 of the ESBWR Design Control Document, the objectives of the initial test program are as listed here on the slide. I will not read these objectives, but you can see that the test program is intended to ensure that the plant is ready to operate, and they will demonstrate that it operates as designed and as expected.

Any questions so far?

(No audible response.)

MS. CAMPBELL: Okay. Next slide.

As I mentioned previously, Section 14.3 addresses development of Tier 1 in the ITAAC which stands for inspections, test analyses and acceptance

criteria.

GEH initially used Tier 1 from the ABWR as a model for the ESBWR Tier 1. In the meantime in March 2007, the NRC issued guidance in Section 14.3 of the SP and its subsections for developing ITAAC. In July 2007, the NRC issued Reg Guide 1.206 which addresses the format and content of applications with additional guidance and clarification for developing ITAAC.

The ITAAC relate to verification that the plant has been constructed in accordance with the license and licensing basis and that the established acceptance criteria have been met. At the end of construction, the NRC must find that these acceptance criteria have been met prior to authorizing operation of the plant. As part of the rulemaking for the ESBWR design certification, we expect that Tier 1 will be incorporated by reference as material that is certified. Following that, the NRC must approve any deviations from Tier 1 as exemptions to the rule and as amendments in a plant-specific license unless the rule is later amended.

Okay. Now we're going to move into the three examples. Any questions so far?

(No audible response.)

MS. CAMPBELL: Okay.

Open Item 14.2-97. What we've quoted here just to set up the format is the summary from the SER that you saw before, and then just basically what we did and the conclusion.

This item was one of the five open items in Section 14.2. It relates to NRC questions regarding the level of detail in the Design Control Document describing the flow-induced vibration testing for reactor internals.

As previously presented to ACRS, this testing is for the purpose of verifying the structural integrity of reactor internals prior to commercial operation. The testing is described in detail in other parts of the Design Control Document supplemented with information in associated licensing topical reports which contain information that may be proprietary to GEH.

Testing includes sensors for monitoring flow-induced vibration and loads on the internals including the steam dryer which is of utmost important, as well as acoustic loads on the main steam piping.

To resolve NRC concerns that Section 14.2 did not include sufficient description of the testing,

GEH added references in the Design Control Document referencing other sections that contain additional detail regarding the testing. However, the more detailed description containing GEH proprietary information for the vibration test program for reactor internals in GE licensing topical reports.

Next item. Any questions on that item?

CONSULTANT WALLIS: Well, I think it's an important issue. I really can't figure out all this detail what it means. I assume the staff knows what's going on.

MS. CAMPBELL: What the slide means?

CONSULTANT WALLIS: I can't understand this slide.

MR. MARQUINO: Can I take a --

CONSULTANT WALLIS: It's an important thing to do this vibration test properly. But this doesn't tell me much about it.

MR. MARQUINO: Well, the short summary of the RAI is we didn't have much detail in Chapter 14 on the FIV testing relevant to the dryer. But we did have detail in other parts of the DCD, and we have a topical report with detail reference from other parts of the DCD.

So to respond to the RAI, we made a clear

tie between Chapter 14 and those other DCD sections that have the detail.

CHAIR CORRADINI: So you're saying that it existed. It just wasn't coupled in properly?

MR. MARQUINO: Yes.

CHAIR CORRADINI: Okay.

MEMBER ABDEL-KHALIK: Will the dryers themselves be instrumented or will the steam lines be instrumented?

MS. CAMPBELL: Both. Both. And that's described in detail in Section 3 Appendix and in the topical report. There's a plan for that.

And then we described it in 14.2 to a degree, and also referenced those other sections.

MEMBER ABDEL-KHALIK: And the analyses that translate the measured quantities into stress levels in the dryer is also included?

MS. CAMPBELL: There's three topical reports for the dryer that couple together to justify that the dryer is acceptable. And one of them is the acoustic loads, one's the end-to-end analysis, and the one is the -- what's the other one called?

MR. MARQUINO: PBLE.

MS. CUBBAGE: Plant-based load evaluations.

MS. CAMPBELL: Okay. That's the acoustic model. The other one is like the mechanical structural model. So there's three topical reports that couple together to justify that the adequacy of the steam dryer and the adequacy of the data that's taken during the testing.

MEMBER ABDEL-KHALIK: Okay.

MS. CUBBAGE: I don't know if you were here. But in the fall, there was a detailed presentation with our staff and contractors on the PBLE method, et cetera, et cetera.

MEMBER ABDEL-KHALIK: Okay.

MS. CUBBAGE: So this is basically just tying in from a regulatory prospective the commitments to complete the vibration testing during start-up.

CONSULTANT WALLIS: It's just tidying things up. It's not a technical issue.

MS. CAMPBELL: Right. We're not talking about the technical issue. We're not changing anything about the technical aspects of it. We're just referencing.

MEMBER ABDEL-KHALIK: I am just trying to make sure that all the pieces fit together, that measuring something, you have to relate it to the physical parameter that you're concerned about. And I

want to make sure that both of them are sort of documented.

MS. CAMPBELL: And they follow the Reg Guide 1.20.

MR. MARQUINO: It's in the acceptance criteria.

MS. CAMPBELL: Okay. So moving on to Open Item 14.3-174, SO1 -- Supplement 1. This is one of the various open items in the previous SER with open items.

For this RAI, GH originally identified certain design features, specifically the building ventilation system rad monitors as the area airborne radioactive monitors. In the meantime, the NRC endorsed NEI guidance 07-03A which was a generic template for radiation protection programs. The NEI guidance includes a section on airborne radiation monitoring using continuous air monitors that can be located in specific areas where workers may be performing activities.

Following further discussion with the NRC, we revised the Design Control Document Section 12.3.4 to discuss these portable continuous air monitors that are addressed by COL Action Item 12-3-2-A. These monitors have the appropriate sensitivity and local

alarm capability to alert workers to sudden changes in radioactivity levels in these local areas. This approach is consistent with NRC-approved industry guidelines applicable to plants and resolves the issue.

Any questions on that item?

CONSULTANT WALLIS: I don't quite understand it. Maybe I'm just being stupid.

But you're talking about portable air monitors. It means things which are carried around. And then you say they're placed in places where there are alarms. Now either they're portable or they're static.

MS. CAMPBELL: Well, the ones that I've seen that are what they call the CAMs are on rollers. They're great big things that look like a ventilation system or something. But that's the ones that I was used to when I worked in a nuclear plant.

CONSULTANT WALLIS: They're portable?

MS. CAMPBELL: They're portable because they roll around.

But also -- Gary, do you want to say anything?

MR. ANTHONY: Certainly. Gary Anthony speaking here.

Basically we have three full levels of radioactive detection in the plant. The ventilation systems are set up with gamma detectors in the ductwork. They detect if anything is coming down the ductwork that would be like a hot particle that's picked up from a maintenance issue into the ventilation system before it gets to the filters or the stack.

The second level of detection we have are grab-sample machines. And these are also permanently installed in the plant. They're considered PINGs or particulate iodine noble gas machines. They take samples. They stick them on little filters. Then you have them inside a lead case that has a very sensitive detector on it, and you can pick up if there's anything airborne in it.

What the NRC decided that those were not enough to protect the local people doing maintenance. So in this COL Action Item, the owner of the plant will also install while maintenance is being done on contaminated equipment local equipment which are basically these CAMs that roll up and you plug them into basically the outlet wall socket. And they have check sources in them and you can actually HP services right there in front of them. There's usually a small

red siren on the top, and if it ever triggers when the HP's not around, the people in the area know to leave the area. On a loss of power, they also trigger off indicating they're not working too.

CONSULTANT WALLIS: They're rollable. They're rollable.

MR. ANTHONY: Rollable. Some are 1,000 pounds. You could push to them.

MEMBER RYAN: Probably about the size of a TV on a cart.

MS. CAMPBELL: They're also making hand-held monitors.

MR. ANTHONY: There are some new companies that have some very small ones. But we're getting them.

CONSULTANT WALLIS: That's okay.

MS. CAMPBELL: Okay. Moving on. We've just got one more item.

Okay. Open Item 14.3-413. Okay. This Open Item relates to verification of the design features that assure trip coordination between battery charges and uninterruptible power supply input rectifiers with inverters. The features are to prevent safety-related EPS inverter trips in the event of a grid disturbance during ESBWR operation in the

islanding mode.

GEH originally included information in a Chapter 8 RAI response regarding the electrical system design features, but had not yet added an associated ITAAC. As a result of this RAI, GEH added an ITAAC to verify design features for the trip coordination.

Any questions on this item?

(No audible response.)

MS. CAMPBELL: Okay. So in summary, we've addressed the SER with Open Items issues that were identified for Chapter 14. The ones that were outstanding and the ones that we discussed today were just examples of those.

Any questions?

MEMBER STETKAR: I have --

CHAIR CORRADINI: John does.

MEMBER STETKAR: -- three or four questions. And they tend to get to be specific because I'm a specific kind of guy.

One question I had was the ITAAC for the control room heating ventilation and air conditioning subsystem. And in the Tier 1 document, the ITAAC will specify that analyses of the control room heat-up must be done based on as-built, as-installed conditions. Okay? I can do analysis. I understand.

Will a test actually be done to confirm that the control room maintains the required temperature using only passive heat sinks where the occupancy and normal heat loads? An actual test? In other words, turn off ventilation for three days and let it heat up and confirm that indeed it meets the design criteria. It's pretty easy to do. Will that test be done?

CONSULTANT WALLIS: Perhaps it agrees with the analysis.

MEMBER STETKAR: I don't even care whether it agrees with the analysis. But will that test be done?

MS. CAMPBELL: No. Because --

MEMBER STETKAR: Why?

MS. CAMPBELL: -- that's a design -- you can't create Design Basis conditions to do a test like that.

MEMBER STETKAR: I'm sorry. You have the heat loads in the control room. You have the people. I can shut off ventilation. In fact, I had one power plant who actually had enough confidence in their analysis that did that.

MS. CAMPBELL: I would postulate that if you were going to do a test like that, it might be

after the plant's operating. I'm not sure you could actually set up that type of a heat load with --

MEMBER STETKAR: You can do it. I wouldn't want to do it when the plant was operating unless I had a lot of confidence in my analysis. But you could do it during pre-start-up testing where you have all of the equipment energized in the main control room and you have human beings who live there.

MR. MARQUINO: We have not committed to such a test.

MEMBER STETKAR: I mean, it seems like an important -- this passive heat removal from the control room seems like a pretty important design function that you're hanging your hat on. And I want reasonable assurance that that design function -- the same as a pump or a pipe or a valve or a circuit breaker -- really works. You don't do analysis of a pump to see that it'll pump flow. You measure the pump flow.

MR. MARQUINO: We just got through a big discussion about the zero percent exceedance weather conditions. So you certainly could not do a test and compare it to the analysis that we have because the weather conditions wouldn't match. The outside air coming air is contributor to the resulting control

room temperature.

MEMBER STETKAR: I recall it's a contributor but a rather small contributor. Most of the heat loads are the actual equipment inside the control room.

CHAIR CORRADINI: Can I just rephrase John's question?

I mean, what I guess he's asking is are you going to do any sort of control room heat-up or cool-down testing in your test program. And the answer is no.

MR. MARQUINO: No, we don't have any test planned. We have validations compared relative to the heat loads and I believe the concrete. But we do not have a commitment to do a test.

CHAIR CORRADINI: Okay.

MEMBER STETKAR: Second question.

CHAIR CORRADINI: Then we have to ask the staff.

MS. CUBBAGE: Well, it would be comparable to an ITAAC that's going to verify the thickness of concrete. We're not going to simulate a seismic event on the building.

MEMBER STETKAR: It would be comparable to an ITAAC that says I do a pre-op test to measure the

flow from a pump.

MS. CUBBAGE: This is a lot more complicated I think.

CHAIR CORRADINI: Go ahead, John.

MEMBER STETKAR: I don't know why it's more complicated. But that's okay.

The Instrument Air System -- I know there are ITAAC that specify requirements to verify the containment isolation functions and the high-pressure nitrogen system and use and service air system.

Designs of those systems in the DCD state that during shutdown operation, the Instrument Air System is connected to the drywell to support equipment that's normally supplied by high-pressure nitrogen. The question is -- and I don't know. This is a system question and you might not have the right people here. Are any safety-related or RTNSS -- I k now no safety-related equipment except that -- but are any RTNSS components supplied by the Instrument Air System during shutdown? I don't know. I mean, that's a question.

If the answer to that is yes, then I was curious why there are no ITAAC to demonstrate that instrument air indeed will be available because it's actually used to support some risk or safety

significant equipment.

If the answer is no, it doesn't supply any RTNSS, I'm pretty happy with it.

MS. CUBBAGE: Or they would be fail-safe. We'd have to look into that or they'd have to look into that.

MEMBER STETKAR: I just don't know. I mean, I didn't have the wherewithal to try to go through all the systems and figure out what valves are pneumatically operated and how they would be operated during shutdown modes.

MR. ANTHONY: Gary Anthony speaking.

I understand the system of high-pressure nitrogen and instrument air. If I could take a few minutes and take a look at Chapter 19 and just go through. There's so many line items in there. I don't want to speak out of --

MEMBER STETKAR: Yes, I was --

MR. ANTHONY: There's like two or three tables in there that we could go through real quickly and just --

MEMBER STETKAR: Why don't we put it as a take-away and maybe we can get back the next time we get together?

MS. CAMPBELL: And also, if you look at

Chapter 14 in Tier 2, it has discussion of the critical components. And it identifies certain RTNSS complaints -- how we screen for ITAAC. So that might give you some additional information.

MEMBER STETKAR: Okay.

MS. CUBBAGE: But I do know that if it was a support system for a RTNSS system, it would have been scoped into RTNSS in Chapter 19.

MEMBER STETKAR: Well, except that I don't know how that filtered through the shutdown stuff because the shutdown risk assessment isn't quite as robust as the full power.

During full power, it's clear. It's isolated. Instrument air -- it's invisible for full power because it's normally isolated from the high-pressure nitrogen system. It may support stuff out in nonsafety-related stuff out in the other part of the plant.

But I specifically focused on the fact that it is the only pneumatic supply to the equipment in the drywell during shutdown operation. I mean, that's at least what's stated in the DCD.

MR. HAMON: This is Dave Hamon.

The reason we did that is during the outage we are getting our people inside the -- room --

MEMBER STETKAR: Sure.

MR. HAMON: We're concerned about nitrogen leakage so we have to switch it over.

MEMBER STETKAR: I understand.

MR. HAMON: And certainly --

MEMBER STETKAR: Advocate that.

MR. HAMON: -- as I recall, I don't think HPNSS or Instrument Air either one is supporting -- I mean, they might be supporting some isolation valves or stuff. But --

MEMBER STETKAR: Well, isolation valves -- containment isolation function is in there. I'm just thinking about the availability of air to support active RTNSS-related functions during plant shutdown.

MR. HAMON: We'll have to look into that.

MEMBER STETKAR: Yes, take a look at that.

And I think the only other one that I wanted to mention or I had a question about is the ancillary diesel generators. And this might be just the way the bullet items are summarized in the DCD.

The system description says that when I lose 480-volt power at the bus, the normal buss feed breaker will trip, and the ancillary diesel will start automatically and the output breaker from the ancillary diesel will close automatically. That's

what the system description at least says. So it's an automatic start. Close the diesel onto the bus.

The bullets that I read for the performance testing say that proper automatic start-up of the diesel will be verified. And proper operation of the diesel when manually connected to the electrical bus, the testing will include verification that voltage and frequency are maintained within design limits when connection to the bus is made or interrupted and that overspeed limits are not exceeded when the diesel generator is unloaded. So the third bullet is kind of the loading capability.

But it specifically says when manually connected. And the question is is the capacity of the ancillary diesel large enough that it can automatically supply all of the loads that are normally connected to that bus.

MR. HAMON: Dave Hamon again.

The answer to that is no, it cannot handle all of this.

MEMBER STETKAR: Okay. So something has to shed loads.

MR. HAMON: The ancillary diesel is only sized to power the RTNSS load during the RTNSS loads that you're going to do in the short term.

If you want to power virtually all of the other loads, we have to have the standby diesel generators which are large capacity but are not RTNSS.

MEMBER STETKAR: Well, am I misinterpreting the design when it automatically starts and loads onto the bus with all of the other loads connected to it?

MR. HAMON: We'd have to John Strayhal to confirm this. I believe what John has told me in the past is that you basically trip all the loads and then re-load the ones that you want to keep on the bus.

MEMBER STETKAR: Who trips them? An automatic trip or a manual trip?

MR. HAMON: As part of the start sequence for the diesel, you automatically trip the loads off the bus.

MEMBER STETKAR: If that's the case, that's fine. But I --

MR. HAMON: And then they reload the components that the ancillary diesel is designed to support.

MEMBER STETKAR: I didn't necessarily read a test that tests that load shedding function.

MR. HAMON: Yes. I don't know the details on the test.

MEMBER STETKAR: Because just verifying that the diesel will start on a loss of voltage isn't the same as -- unless I'm misinterpreting some of these bullets in here.

If you're looking for a reference, you probably found it already. It's Section 14.2.8.1.67 in Section 14. And the description of the automatic operation of ancillary diesels is in Section 8.3.1.1.9. And again, this is from DCD Rev 7. So if something has changed between 7 and 8, I don't know about it.

MS. CAMPBELL: I'm not sure. Is John Strayhal on the phone? I'm not sure if he is.

MR. STRAYHAL: We're going to go get him right now.

MS. CAMPBELL: Okay. He'll be able to sort this out.

MEMBER STETKAR: Because I originally thought the ancillary diesels were all manual until I went back and reviewed the section that tells me they automatically start and close onto the bus which --

MR. HAMON: John will be able to answer that, I guess.

MEMBER STETKAR: It means there should be some load shedding or something.

CHAIR CORRADINI: Do you --

MEMBER STETKAR: I'm done with my questions for GEH.

CHAIR CORRADINI: Okay. I have just one general question that I should know but I can't remember. So I'm just going to ask you straight up.

What of the passive safety systems are directly going to be tested so that I can re-read it just for my own -- because I remember the GDCS but I don't remember some of the other systems. What other systems will be tested in the start-up testing?

MR. MARQUINO: The isolation condenser will be tested.

CHAIR CORRADINI: GDCS will be tested through an open -- the squib valves won't be in place if I remember correctly when we asked this question previously. There'd be a flow test without the squib valves in place is my memory.

MR. MARQUINO: Right.

CHAIR CORRADINI: Okay. Anything else?

MR. MARQUINO: That's it. That's the extent of the start-up testing of the passive systems as an integrated test.

CHAIR CORRADINI: Okay.

Other questions? John? Other committee

members?

(No audible response.)

CHAIR CORRADINI: Why don't we take a break now for --

MR. McLAMB: Chairman Corradini, this is John McLamb from GEH.

CHAIR CORRADINI: Oh, you have information?

MR. McLAMB: We have John Strayhal here to answer John Stetkar's question. I guess, John, if you could re-phrase it or repeat the question.

MEMBER STETKAR: Yes. Okay. Yes. John, the description in the DCD for the ancillary diesel says that on loss of power at its bus, the normal bus feed breaker will open, the diesel will start and the diesel output breaker will close automatically. That's in Section 8.3.1.1.9 of the DCD. So that tells me that the diesel starts automatically and it closes onto the bus automatically.

We were told that the capacity of the ancillary diesel is not sufficient to carry all of the loads connected to that bus so that there must be some load shedding that occurs. Is the load shedding automatic?

MR. STRAYHAL: This is John Strayhal at

GEH.

The load shedding -- fired because the bus line-up will have the diesel battery charger on it that helps it keep itself charged on the bus which is normally powered from the pit bus. It will have its fuel oil transfer pump so that if its day tank -- small day tank -- does run down, it can pick up fuel from its own tank. And it will have the air conditioning system for that building -- HVAC -- heating and air conditioning -- on that always energized for any power bust.

Those breakers do no shed. They're the only breakers that are closed in on the bus all the time unless the COL applicant decides to close in another breaker or so that the initial starting diesel can take when it closes in. Once the diesel closes in, all other breakers are manually placed on. And in that case, we would be talking about MDCIS support and HVAC for the MDCIS to keep it cool before its batteries run out -- which are two-hour batteries -- because we don't want to lose MDCIS if we can help it.

Now if we go all the way out and we're getting close to the 72-hour point, we're manually going to load other items.

MEMBER STETKAR: John?

MR. STRAYHAL: Does that answer your question?

MEMBER STETKAR: I'm not sure. Let me back out of the design basis station blackout need for the ancillary diesel and think about normal plant operation -- plants operating normally at 100 percent power -- and suppose I lose the normal power supply to the ancillary diesel bus. Transformer fails. Circuit breaker trips open. Are there normally operating loads in excess of the ancillary diesel output capacity connected to the bus under those conditions?

MR. STRAYHAL: No.

MEMBER STETKAR: No? Okay.

MR. STRAYHAL: That is the answer. But the answer is the only loads on that bus will be if potential fuel supply starts --

MEMBER STETKAR: Okay.

MR. STRAYHAL: -- the HVAC and its own battery. All other loads are open procedurally.

MEMBER STETKAR: Okay. Procedure. Administratively controlled open?

MR. STRAYHAL: Yes.

MEMBER STETKAR: Okay.

MR. STRAYHAL: Because at that time, we have no other control power. We consider that -- it's

dead.

MEMBER STETKAR: Fine.

MR. STRAYHAL: If it weren't dead, we consider it dead.

MEMBER STETKAR: Fine. Thanks. That answers the question. Thanks a lot, John.

CHAIR CORRADINI: Okay.

MS. CAMPBELL: Okay. Thank you, John.

CHAIR CORRADINI: Any other questions for the team?

(No audible response.)

CHAIR CORRADINI: Okay. With that, let's take a break now until 3:00 o'clock. And we'll pick up staff after the break.

(Whereupon, at 2:45 p.m., off the record until 3:00 p.m.)

CHAIR CORRADINI: Okay. Let's come back into session.

Wayne, you wanted to give us clarification from yesterday about decay-heat.

MR. MARQUINO: Yes. We misspoke yesterday. And I think we were saying that the difference between 17 and 710 megawatts is the core decay heat at five days.

The core decay-heat at five days with

equilibrium core radiation time end of cycle is 16 megawatts. And that's consistent, if you look in Chapter 6, we've got plots of decay-heat versus time. I think you probably remember the number like 20, 19 megawatts at three-day value. And then at five days, it's about 16.

The core offload that's considered in the spent-fuel pool analysis is not equilibrium end-of-cycle core radiation time. The basis for the 17.3 megawatts is you operate the ten years and accumulate five batches of spent fuel in the pool. And then after a 20-day outage starting at Year 10, you start up, you operate for 36 days, and then you have some event that requires a full-core offload.

MEMBER ABDEL-KHALIK: That seems awfully random, doesn't it?

MR. MARQUINO: It may be somewhat arbitrary. But I want to note that it's a ten-year basis and this is past ten years. But basically this heat load is what sets the capacity of the system. So once you go past ten years on spent-fuel storage, you have to do something. And we cover ten years plus 36 days.

MEMBER ABDEL-KHALIK: But the whole idea is that something happens. You have to offload the

fuel. And your assumption that that fuel had been in the core for 36 days just seems to be totally arbitrary.

I would have been happier if you'd say so you take the 15.83 and add them to whatever the decay-heat for the fuel that had accumulated for ten years which you say is 3.6 megawatts. That seems kind of low. But --

MR. MARQUINO: Yes.

MEMBER ABDEL-KHALIK: -- to say you're going to account for a core that's been in there for 36 days just seems totally arbitrary.

MEMBER STETKAR: These days in the real world, a lot of people decide to do core offloads for major reconstruction which they schedule for normal refueling outages. I mean, granted things can happen any time during the cycle that requires you to shut down and offload the core. But in the real world, people tend to do core offloads for major modifications that they plan for during their fueling outage.

So going through the outage. Pull your core out. Put it over in the spent-fuel pool which then you have the full equilibrium and the core decay-heat.

MR. GELS: Wayne, this is John Gels from GEH. I just thought I might clarify one thing about that 36-day assumption.

I think it may have been somewhat arbitrary as far as the specific choice of 36 days. But the idea was that it allowed the core to reach a point where it did produce a significant amount of decay-heat while still retaining much of the decay-heat from the previous offload batch. And if you carried out that core all the way to end the cycle, he heat load in the spent-fuel pool would have dropped considerably at the time you offloaded.

MEMBER ARMIJO: So are you looking for the maximum heat load? Are you looking for kind of like worse case? What's wrong with simply adding the spent-fuel heat load and the equilibrium core irradiated heat load but --

MEMBER ABDEL-KHALIK: If you're designing a cooling system for the spent-fuel pool that can handle the accumulated spent fuel over ten years plus if you have to offload the core, it would seem to me that you want to design that cooling system to be able to handle the maximum decay-heat that you would expect under these conditions. And that doesn't make any sense -- the 36 days.

MR. GELS: Well, the 36 days, it's not realistic to combine a 36-day core to full spent-fuel pool heat load of 7.6 that we discussed earlier for a normal condition.

MEMBER ABDEL-KHALIK: I understand that because that includes part of a core.

MR. GELS: That's correct. Yes.

MEMBER ABDEL-KHALIK: Right. But if you add it to the 3.6 which is the spent fuel, spent fuel that's from the previous cycle --

MEMBER STETKAR: That's your total heat load from ten years of spent-fuel storage? If that's your understanding of the 3.6, then --

MR. MARQUINO: The 3.6 corresponds to five batches, four of which have been in the pool for two years or more, and one batch is freshly discharged and it's been in the pool for 56 days.

MEMBER ARMIJO: You said 56.

MR. MARQUINO: Twenty-day outage since -- 20-day outage plus 36 days of operation.

CHAIR CORRADINI: Now that adds up. That adds up.

MR. MARQUINO: So this batch was discharged, put in the pool, and then it sat there for 56 days while the plant was operating for 36 days.

And now you have to offload the whole core into the pool at ten years plus 56 days.

MEMBER ABDEL-KHALIK: What's magic about 36 days? I just can't understand the logic.

MR. MARQUINO: Well, I haven't had time to research the basis for the 36 days. If it was from the URD or the engineer that was doing the decay-heat calculation determined it was a limiting time in the cycle or --

CONSULTANT WALLIS: But isn't it much higher if you go normal core after a lot of operation?

CHAIR CORRADINI: Well, the only thing that's -- I'm curious about. So we understand what you did. Now the question is why you did it.

The only thing I can come up is everything is decaying away. Is this a potential maximum? That's the only thing I'm --

MEMBER ARMIJO: Or approaching a --

CHAIR CORRADINI: Yes.

MEMBER ABDEL-KHALIK: -- a leveling off.

CHAIR CORRADINI: Yes. So we understand what you did. I think now you're going to have at least -- understanding the questions that are being asked -- there's a why behind it that you're not sure of at this point.

MR. MARQUINO: Yes.

MR. GELS: Wayne, this is John Gels again.

The idea is that this does approximate the maximum condition for the spent-fuel pool meaning that as the core operates for a longer period of time, the decay-heat it'll produce after shutdown increases. But at the same time, the fuel that has just been offloaded the fuel pool is --

CHAIR CORRADINI: That's what I was saying.

MEMBER ABDEL-KHALIK: You're balancing a bunch --

PARTICIPANT: But the other complement's much smaller.

MEMBER ABDEL-KHALIK: Anyway, I think you need to demonstrate that this is really a maximum.

CHAIR CORRADINI: Or at least check that the calculation was.

So we leave that as the action item then? Okay?

So we understand that what you did. Now it's the why you did it.

MEMBER ABDEL-KHALIK: Or demonstrate that it's acceptable and it represents the maximum heat load that this decay-heat or spent-fuel cooling system

will be required to accommodate.

CHAIR CORRADINI: Okay. Thank you, Wayne.

Do you want to take the nitrogen issue or do you want to have the staff come up and finish Chapter 14?

MS. CUBBAGE: Only if it's quick.

MR. HAMON: We'd like to quickly take the nitrogen issue again.

We called back to Wilmington and checked on this. And what we were told is that there are no safety-related or RTNSS loads being supplied by the Instrument Air System.

MEMBER STETKAR: During shutdown?

MR. HAMON: During shutdown.

MEMBER STETKAR: Thank you.

MS. PERKINS: Again, my name is Leslie Perkins. And I'm the project manager for Chapter 14 which addresses verification programs.

This afternoon I have up here with me three technical reviewers: Frank Talbot from the Quality and Vendor Inspection Branch, Amar Pal from the Electrical Engineering Branch, and Charlie Hinson from the Health Physics Branch.

Back in October 2008, we briefed the ACRS on the SER with Open Items which was based on the

original five of the DCD. There were several opened items at that time. Today, we're going to focus our discussion on those items that were identifying as being significant open items.

We're going to discuss the resolution of RAI 14.2-97 which deals with the flow-induced vibration test, the resolution of RAI 14.3-413 which deals with the ITAAC verification of trip coordination, and resolution of RAI 14.3-174 Supplement 1 which deals with ITAAC with the airborne monitors.

MEMBER STETKAR: Leslie, before you get going, again, one of the things I was trying to check as I went through the SER was to clearly understand what version of the DCD the SER was written against. And I find statements in Section 14, the current SER, saying things like the staff will confirm that this proposed revision is incorporated into Revision 7 of DCD Tier 1 Section 3.6. Well, we already have Revision 7, if not Revision 8 somewhere.

So I was curious why the SER is saying that --

MS. CUBBAGE: Either that -- or it should have been removed -- one or the other.

MEMBER STETKAR: Okay.

MR. TALBOT: As far as I know, Rev 8 is not in, correct?

MS. CUBBAGE: Rev 8 is not in. But he said something would be confirmed in Rev 7.

MR. TALBOT: Okay.

MS. CUBBAGE: And so if --

MEMBER STETKAR: We already have Rev 7. So I was curious why -- I knew that --

MS. CUBBAGE: Well, these things were written --

MEMBER STETKAR: A while ago?

MS. CUBBAGE: -- a while ago.

MEMBER STETKAR: Okay.

MS. CUBBAGE: So they were written before Rev 7 came in. So then we did the confirmation.

MEMBER STETKAR: Okay.

MS. CUBBAGE: So that was --

MEMBER STETKAR: Well, good. Other sections that basically were pointing toward things that are going to be from Rev 7 to Rev 8. So --

MS. CUBBAGE: In those rare cases where there are things that rely on Rev 8 to resolve them, yes.

MEMBER STETKAR: Okay. And a lot of this stuff is basically editorial. But it's going to get

cleaned up sometime between now and --

MS. CUBBAGE: Yes.

MS. PERKINS: And one of the RAIs that were going to be discussing -- the 14.3-174 -- is a confirmatory item for Rev 8 because you need to provide a revised response.

MEMBER STETKAR: Okay.

MS. PERKINS: And I'm going to turn it over to Frank to discuss the resolution of RAI 14.2-97.

MR. TALBOT: Okay. The NRC staff had concerns with Subsection 14.2.12.2.11 and Rev 5 for the flow-induced vibration test descriptions and acceptance criteria for reactor internals. They were too broad and general. So the staff had noted that GE had licensing topical reports that would get into the explicit details of this subject matter. And you see the GE topical reports up on the screen -- reactor internal flow-induced vibration assessment program, and two topical reports for the steam dryers.

Also, DCD Subsection 3.9.24 is referenced in Subsection 14.2.8.2.11. And there's further reference in that Subsection to a DCD Section 3L which gets into all the specifics of the reactor internal flow-induced vibration program. And those three

topical reports in essence comply with the guidance in Reg Guide 1.2.0. And that's the NRC's comprehensive vibration assessment program during pre-op and start-up testing. There's about 19 pages of guidance in that Reg Guide related to how you'll do testing of the ESBWR prototype plant.

And if you have additional questions about how they comply with that Reg Guide 1.2.0, we do have other technical staff from the EMB2 that can answer detailed specific questions about how they comply with Reg Guide 1.2.0.

And then there was also two other pre-op tests that had RAIs on them too. And they have been resolved also. So there's a total of three basically RAIs related to the flow-induced vibration assessment program.

Are there are any questions that you have related to this subject matter?

(No audible response.)

MR. TALBOT: Okay.

MR. PAL: My name is Amar Pal. I'm going to discuss about the RAI 14.2-413.

This RAI is all about the trip coordination verification in the UPS rectifiers and monitors. And the concern came because of the loss of

a monitor due to the high -- importance. So trip coordination is very important. So we asked for an ITAAC to verify that. And the applicant provided the ITAAC. The ITAAC verified that the rectifier and battery charger would achieve the -- monitor. So that way the monitor would get its supply from the battery. So the monitor would be set.

And that closes my presentation of this area.

MR. HINSON: Okay. My name is Charles Hinson. And this particular RAI was included in the last time we briefed the ACRS in 2008, I believe. It concerned GE providing an ITAAC for the airborne radioactivity monitors which are used to monitor airborne radioactivity levels for normally occupied areas of the plant in which there exists a significant potential for airborne contamination.

GE in response to this had added an ITAAC in Tier 1 for these airborne radioactivity monitors in Section 3.4. And this ITAAC addressed the monitor sensitivity and location criteria. However, it did not specify which monitors the ITAAC applied to.

So the staff asked another question. And in response to this staff request to identify which monitors the ITAAC applied to, GEH modified their

response to state that portable continuous air monitors instead of fixed, in-plant monitors would be used to meet the requirements for worker protection. And GE stated that these continuous air monitors or CAMs will be used in occupied areas to alert personnel to sudden changes in airborne radioactivity concentrations and will have alarm setpoints set at a fraction of the concentration values of 10 CFR 20, Appendix B, Table 1 for radionuclides.

CONSULTANT WALLIS: That would be sudden. Sudden is put in to indicate that they have a quick response? Is that what it is? And presumably alerts also to slow changes if they're significant.

MR. HINSON: Well, right.

CONSULTANT WALLIS: There's nothing magic about sudden.

MR. HINSON: Exactly. Changes. But it includes --

CONSULTANT WALLIS: It means they have a quick response.

MR. HINSON: Right. A quick response. Yes. Okay.

MEMBER ARMIJO: What about people going into areas where there is no monitor, there is no CAM and there might be contamination airborne? Do they

just roll the CAM in first and do a survey and then people know?

MR. HINSON: Well, there are also like GEH stated before, there are monitors in the exhaust vents for various parts of the plant. So those can give you an initial determination if there's airborne areas that are not monitored by a continuous air monitor. And those have enunciation in the control room and read-out in the control room.

So if you see airborne levels rising in certain parts of the plant, you can bring portable -- you can have technicians go in and then you can roll in a CAM and focus on where that is coming from.

MEMBER ARMIJO: So there's just no chance that somebody could go into an area that does have airborne and not know that there was airborne in there?

MR. HINSON: Yes. Well, like I said, there are monitors that will give you an indication at the exhaust vents to several of the plant areas.

MEMBER ARMIJO: Okay.

MR. HINSON: That will give you initial inspection and then you can go in.

CONSULTANT WALLIS: Since personnel move about, these CAMs have to move about too.

MR. HINSON: Well, the CAMs I just said, the number of them are determined by the COL applicant. But usually the criteria is that they're placed in areas where there's potential for airborne radioactivity as well as there could be work on systems that could result in airborne leaks.

MR. MARQUINO: This Wayne Marquino, GEH.

We have at the moment to the health physics program that would cover access to an area that's not normally occupied. And Dr. Armijo, that's the answer to your question. If you have to make an entry to an area that hasn't been previously occupied and is suspect, health physics technicians would survey the area before entry.

This requirement that is under discussion in 14.3-174 specifically refers to normally occupied areas.

MEMBER RYAN: I've got a little follow-up question. One is I see any fraction of the concentration to the CFR 20. Can you clarify that a little bit? What fraction? You might want to do the summary and because of their sensitivity --

MR. HINSON: There's a criteria in the center review plan that says that airborne monitors should be capable of detecting 10 DAC-hours.

MEMBER RYAN: Ten DAC-hours. Okay. That's the answer. Got it.

MR. HINSON: And this fraction is -- these CAMs even are smaller.

MEMBER RYAN: I'm with you. I just wanted to make sure I understood what the basic criteria was.

And Graham, I'd offer you the thought that a portable monitor is really much better in my mind in a lot of cases than a fixed. Because if the fixed goes down for whatever reason, then the operation stops. But if you've got a roll-around CAM, it's very quick to change out and not lose any of the work activity of the plant. So it's in my view kind of a good way to go. You need some fixed monitors for other reasons.

CONSULTANT WALLIS: Yes. I was just thinking the work activity isn't always a static thing, that a group of people can be working and move along. So presumably then you move --

MEMBER RYAN: You can kind of roll around with it if you have to.

MR. HINSON: Right.

MEMBER RYAN: But it's an effective way to make sure the monitoring is fairly straightforward an easy to keep up.

MR. HINSON: Yes, because I had spoken with several of the inspectors in the regions. And what they were telling me is that plants are going more and more toward using the continuous air monitors as opposed to having fixed monitors in line. I think that was the criteria more so back in the '70s for the operating plans. But I think nowadays, the CAMs have become better and they're using those more and more.

And so I was getting to the operating program that you'd mentioned.

GEH stated that the airborne radiation monitoring operational considerations are the COL applicant's responsibility for COL information item 12.3-2-A. And that COL information item, operational considerations, states that airborne radiation monitoring operational considerations such as the procedures for operation and calibration of the monitors as well as the placement of the monitors are the COL applicant's responsibility.

Generic Template NEI 07-03A provides guidance to the COL applicant on the resolution of this COL item. And this template states that surveys to assess airborne radioactivity levels are performed with continuous air monitors with appropriate media reflecting particulate iodine, gaseous and tritium

samples. And CAMs provide a means to observe trans- and airborne radioactivity concentrations that are used to alert personnel to changes in airborne radioactivity concentrations.

And like I said, the health physics program is set up based on 07-03A which defines what a radiation protection program should contain. It talks about monitoring areas before work is done or before entry.

CONSULTANT WALLIS: But presumably the alarm is set off not by the suddenness of the change but by its magnitude.

MR. HINSON: Right. Or the transient, degree of change.

The next slide.

Okay. Since GEH modified the DCD to state that portable radiation monitoring instrumentation will be used to conduct airborne sampling and monitoring, and ITAAC don't apply to portable equipment, GE removed the ITAAC for airborne radioactivity monitoring from DCD 2-1.

And the staff finds that GE response acceptable because the portable CAMs used to meet the requirements for worker protection and the local areas will meet the sensitivity and location criteria

specified in the SRP to ensure that plant personnel are not inadvertently exposed to airborne contaminants in excess of the limits provided in 10 CFR Part 20.

And also, like we said before, the supplement -- the portable continuous air monitors -- the ESBWR design also has seven airborne radiation monitors in the process radiation monitoring system which monitor the exhaust air from the turbine building, reactor building and fuel building exhaust ducts for radioactivity and provide read-out and enunciation in the control room. And there's also use of grab samples that are available.

On this basis, the staff concludes that RAI 14.3-174 is resolved. And as was said before, this is in fact a confirmatory item because this resolution will appear in DCD Rev 8.

MS. PERKINS: That concludes the staff's presentation. Any questions? Comments?

CHAIR CORRADINI: John?

MEMBER STETKAR: Yes. Thank you.

I wanted to follow up on a couple of questions that I asked.

Back in October of 2008, according to my notes here -- and at that time they were kind of held as follow-up items -- the first question is DCD Tier

1, one of the functions of the main condenser is listed as the main condenser can accommodate turbine bypass systems steam flow to mitigate abnormal events. And the R&D ITAAC specified for the main condenser in terms of integrity -- things like that.

There are no ITAAC specified for the circulating water system which indeed would be required to condense that steam that's being delivered to the main condenser to mitigate abnormal events. So I was curious why there are no ITAAC for the circulating water system.

MS. CUBBAGE: GE, would you like to take a stab at that? We don't have the right --

MEMBER STETKAR: The last time I asked this I didn't get an answer from anybody either.

MS. CUBBAGE: Well, I mean, we don't have the staff at the table.

CHAIR CORRADINI: Can I just expand the question?

Maybe I asked this question before and I don't remember the answer. Do the ITAACs cover pre-operational testing?

MS. CUBBAGE: No.

CHAIR CORRADINI: Because historically, circ water systems are tested in the pre-operational

testing in terms of flow --

PARTICIPANT: The functional tests.

MEMBER STETKAR: Well, but there are ITAAC specified for example on -- I'm going to get to the feedwater system. There are ITAACs specified for feedwater systems to demonstrate for example the feedwater pumps can deliver flow, which would also be verified during pre-operational testing. But they're ITAAC because they're focused on specific event-mitigation functions.

CHAIR CORRADINI: Okay. Right.

MEMBER STETKAR: So yes, you're right. It would normally be tested as part of pre-op testing.

CHAIR CORRADINI: But you're thinking there would be more just except in testing, not functional testing as you'd expect here?

MEMBER STETKAR: I'm just curious why there's no ITAAC --

CHAIR CORRADINI: Fine.

MEMBER STETKAR: -- specified for --

MR. TALBOT: We could go ask John Segala in the Balance of Plant Branch of NRO that question for you and get you an answer.

MR. ANTHONY: I can give you a little bit here.

In Chapter 10, the circ water system is outside the DCD boundaries. It's considered a conceptual design system. The CDS is one of the only ones in the DCD. And since it hasn't been built or any design portion in there, we can't do an actual ITAAC on something that's not described. We only describe it in flow rate needed to cool the system. It's actually considered a CDS portion.

MEMBER STETKAR: That might be a good answer. I sort of like that answer.

MR. TALBOT: Is that a COLA application. Is tat site-specific for the COL applicant?

MR. ANTHONY: Yes. The COL must design the circulating water system and present it to the NRC.

MR. TALBOT: Okay.

MEMBER STETKAR: Okay. That would probably work.

Let me try one that may not work as easily.

There are as I just mentioned ITAAC specified for the main condensate and feedwater system. And if I read them, they're mostly focused around the ability of the condensate and feedwater pumps to deliver a certain amount of flow. And the

way ITAAC are written is it can be done by analysis or type testing of a particular pump. There's a couple in there on the ability to isolate things.

The turbine component cooling-water system cools the condensate and feedwater system in addition to a lot of other loads out in the turbine building, but in particular the condensate and feedwater system. Why aren't there any ITAAC on the turbine component cooling-water system which is not a COLA item?

MS. PERKINS: I don't know if GE wants to address the question.

MS. CUBBAGE: I missed the preamble there. But it's not a RTNSS system.

MEMBER STETKAR: It's not a RTNSS system, but it supports the feedwater system. If I don't have turbine component cooling water, I don't have feedwater -- period -- end of story. But I don't know why it's not a RTNSS system, but apparently it's not a RTNSS. I know why it's not a RTNSS system because it's really not modeled in the PRA. So it didn't get a chance to become a RTNSS system.

It's sort of modeled. We had the discussion in the PRA. Turbine building component cooling -- it's modeled very simplistically.

So it in principle had some chance to show

up but not a lot.

MS. CUBBAGE: Well, as you know, there's a graded approach to what systems, structures and components have ITAAC. Certainly anything that's safety-related or RTNSS does have ITAAC.

The absence of an ITAAC does not obviate the applicant's commitment to build these systems, structures and components as described in the FSAR. And there would be additional operational programs, for example, the initial test program with pre-op and start-up testing. They would also verify whatever functions were required.

So I guess the short answer is this is screened out from the graded approach to what required ITAAC. But I'm trying to look some stuff up for you here. And we don't have our technical staff in the room that can speak to this.

MEMBER STETKAR: I understand that you have to draw the line somewhere. But on the other hand, there's ten different specified design commitments listed in a table for ITAAC condensate and feedwater. They get pretty doggone specific. And not even anything that mentions that the thing that has to work so that this equipment has a prayer of being able to meet these criteria should be verified that it

delivers flow or maintains temperature or does something. I'm just curious.

Let's leave that so we can keep moving.

One of the other questions that I had, in DCD Section 14.2.8.2.26 summarizes a loss of -- it's called a turbine trip and generator load rejection test. And that test is performed at power. It's specified that the generator has to be putting out more than ten percent power. It says low power, but more than ten percent.

So it's connected to the grid. You basically disconnect the plant from the offsite grid for 30 minutes and verify that everything works. And the question I had asked Mac two years ago was is there a regulatory requirement for that type of test because that's a fairly severe transient to place on an operating nuclear power plant -- to actually disconnect from the offsite grid under load.

So I was curious what the basis for requiring that test is. And at the time, nobody had a good answer -- whether there was a strict regulatory requirement, what the genesis of that test is.

Anybody have an answer?

CHAIR CORRADINI: I hear none.

MEMBER STETKAR: Because it's curious to

me, for example, why I would disconnect all offsite power from an operating nuclear reactor for 30 minutes. For example, I wouldn't shut off ventilation to a control room which is a lot more benign.

(LAUGHTER.)

CHAIR CORRADINI: That was a slippery way to bring that in again.

MEMBER STETKAR: Well, no, I'm actually concerned about it. I'd like to understand the requirement --

MR. TALBOT: I've got our slides from 2008. And there was an RAI on AC power distribution system pre-op tests. But it wasn't related to the --

MEMBER STETKAR: No, this was a question that I raised specifically when I was going through the tests. And at the time, my note said that -- I asked both GEH and the staff. And GEH's response at the time was well, this type of test must have some type of regulatory requirement. I asked the staff what that was. And I was told well, we'll have to get back to you because nobody really knew what the basis for that requirement was.

MR. TALBOT: We will get you an answer.

MEMBER STETKAR: Thank you. I would like one.

MR. TALBOT: Okay. I'm curious now.

MEMBER STETKAR: I was curious because it's something that would get your attention, for example.

MR. TALBOT: I'm looking through the SE and I didn't even see that test abstract even brought up in the evaluation.

MEMBER STETKAR: Yes, I didn't see it. I went through the DCD myself, and that's where I came up with a few of these omissions.

And as I said, it's documented in Section 14.2.8.2.26 of Rev 7 of the DCD. And it's been there for a while.

MEMBER ARMIJO: It's not likely to have disappeared in Rev 8.

MEMBER STETKAR: It's not likely to have disappeared because it's been there through at least Rev 5, 6, 7.

MEMBER ARMIJO: So somebody must want it for some reason.

MEMBER STETKAR: Yes. And if there's a requirement to do it and everybody's on board that it's something that needs to be done, then it's fine. I just --

CHAIR CORRADINI: Let's just leave it and

let's move on. Okay? But I've got it noted.

Other questions for the staff?

(No audible response.)

CHAIR CORRADINI: Hearing none, shall we move on to Chapter 16?

MR. HAMON: Just a second. On one of the earlier questions about the turbine component cooling water system, although there are no ITAACs, there is a start-up test defined in Chapter 14.2.4. It's in Section 14.2.8.152 that defines pre-operational tests for the system to demonstrate it's functioning as designed and its various flow modes and --

MEMBER STETKAR: 14.2.8.1?

MR. HAMON: 52.

MEMBER STETKAR: 152.

MR. HAMON: .2.8. --

MEMBER STETKAR: -- .152. Yes. And that's a start-up test?

MR. HAMON: That's a start-up or pre-op test. Yes. Probably pre-op.

MEMBER STETKAR: Okay. Thanks. But no ITAAC?

MR. HAMON: But no ITAAC, yes.

MR. TALBOT: I did find something in our SE related to the turbine trip and generator load

rejection test on page 1460 of the SER.

One of the success criteria, "The plant shall not scram following a turbine trip regenerator load rejection test." But it's not specific about the regulatory requirement. But it did resolve RAI 14.2-100. So that's a little bit of information I can give you. But I think we kind of owe you a better answer.

MEMBER STETKAR: Yes. And there's actually two. There's the turbine trip and generator load rejection test. There's also a reactor full isolation test that I don't have right at my fingertips right now except it was in my notes. That's described in DCD Section 14.2.8.2.28.

MS. CUBBAGE: Getting information emailed to me. And it refers to Rev Guide 1.68, demonstrate that the dynamic response of the plan is in accordance with the design for the case of full load rejection.

MEMBER STETKAR: Okay.

MS. CUBBAGE: Method used to open the generator breakers by simulating an automatic or manual trip should be selected such that the turbine generator will be subjected to the maximum credible overspeed condition. Tests should be initiated with the plant's electrical distribution system aligned for normal full power operations. Rev Guide 1.6NN. Rev

Guide l.6.8NN.

MR. TALBOT: But that Appendix A-NN, right?

MS. CUBBAGE: This was emailed to me, so I'm just reading it.

MR. TALBOT: I think it's Appendix A-NN.

CHAIR CORRADINI: Of 1.68?

MR. TALBOT: Yes. There's a big appendix that goes through the whole plant and tests the whole plant. And that's getting to a piece of Appendix A which I believe -- I'll have to look at it.

MEMBER STETKAR: That's a load rejection test. This particular test goes further than just rejecting loads. It disconnects you from offsite power. So I can open up a generator output break or still keep offsite power connected to the plant and test the ability to turbine overspeed trip and the load rejection capacity.

But this particular test -- this connects you from offsite power and requires that offsite power must remain disconnected for 30 minutes.

MS. CUBBAGE: JJ says demonstrate that the dynamic response of the plant is in accordance with the design for a condition of loss of turbine generator coincident with a loss of all sources of

offsite power.

MEMBER STETKAR: Okay. That would do it. And that's Rev Guide 168 --

MS. CUBBAGE: JJ.

MEMBER STETKAR: JJ. Thank you. Fine.

CHAIR CORRADINI: Now let's move on to Chapter 16. We're a little bit behind.

Thank you.

MS. CUBBAGE: John, while they're changing up, if it makes you feel any better, you found the one typo in Chapter 14 that pointed to Rev 7. That item had already been identified in GE's factual accuracy check.

MEMBER STETKAR: Glad to see somebody else is reading it.

MS. CUBBAGE: Yes.

CHAIR CORRADINI: And for this you get?

(LAUGHTER.)

MS. CUBBAGE: Yes, there should be a prize for that.

CHAIR CORRADINI: Sara, go ahead.

MS. ANDERSEN: All right. My name is Sara Andersen. I'm with GEH Regulatory Affairs. And I'm going to talk about Chapter 16, Technical Specifications.

For Chapter 16, all of our RAIs have been addressed and are in the resolved status. And all previous open items have been closed. There were about 50 open items at the time of the 2000 SER open items.

I'm going to discuss two topics today. The first one is an item of interest from the 2007 SER with open items. And that is RAI 16.0-1 which had to do with completeness of the generic technical specifications. And the other topic of interest that I'm going to talk about are the tech specs that we developed for the passive safety systems.

All right. RAI 16.0-1 had to do with the completeness of the generic technical specifications. GEH was asked how we chose the limiting conditions for operation and how we ensured that we are meeting the requirements of 10 CFR 50.36. What we did was back at Revision 1 of our DCD which was around 2006, we did a comprehensive and systematic review of the ESBWR design against the 10 CFR 50.36 criteria which deals with setting the scope for tech specs. So that's how we came up with our initial scope.

And since then, what we've been doing is continuously monitoring all of the changes that got made to all the other DCD chapters and evaluating them

to determine whether tech spec changes were warranted and if they were, we would have made those tech spec changes.

All right. Any questions on that before I move on to the next topic?

(No audible response.)

MS. ANDERSEN: All right. The next topic is pretty broad. It's the passive safety system tech specs and just some general items about how we develop them. They're developed generally based on the BWR-6 standard technical specifications which is NUREG-1434, Revision 3.1. And for the passive safety systems, we based the tech specs on the specs that were in the STS for systems with similar design functions. We tried to develop specs that were consistent with the NUREG and utilized the established precedents in the STS.

And now I'm going to go through some specific specifications that we developed.

The first one is ADS, the required action and completion time. Generally speaking, these are sort of generalizations. But if you have one required ADS valve inoperable, you have 14 days to restore it. This is the same as you would have for an ADS valve in the STS.

Surveillances that we've developed, one is

to verify adequate nitrogen --

CONSULTANT WALLIS: The symbols here, this looks like greater than 14 days.

MS. ANDERSEN: Oh, sorry. That was meant to be an arrow.

CONSULTANT WALLIS: It looks like equal or greater than.

MS. ANDERSEN: No.

CHAIR CORRADINI: It's just an arrow.

MS. ANDERSEN: There's no mathematical symbols in --

CHAIR CORRADINI: This is like when you text message. This is the new way --

CONSULTANT WALLIS: So what you mean is less than 14 days. It's got to be restored within 14 days.

MS. ANDERSEN: That's correct.

CONSULTANT WALLIS: Okay.

MS. ANDERSEN: All right. The surveillances, we verify adequate nitrogen supply pressure to the SRVs. And that's done every 31 days. And that's again the same as the STS.

You verify initiator continuity every 31 days. So that would be squibs for the DPVs and solenoids for the SRVs.

And you verify actuation on an actual or simulated initiation signal every 24 months. And that will overlap with the logic system function performed in the I&C portion of the tech specs to provide a complete functional test of the system.

CONSULTANT WALLIS: Now is this all automated so that you just have to ask for it to do it and it does it? Or does someone have to go and connect things to things?

MS. ANDERSEN: A lot of it will be automated. That's not exactly decided yet.

Early on we were trying to take credit for maybe some of the automated testing. But we went back to just matching our surveillances to read like the STS for now.

CHAIR CORRADINI: So that implies that it could be automatic or manually checked by an operator going to look at something --

MS. ANDERSEN: Right.

MEMBER STETKAR: Sara, before you get off the ADS valves, the plant has 18 safety relief valves, right? Ten of them can be actuated for -- let me call it an active ADS function. Eight of them are strictly passive safety relief valves.

There are no LCOs for operability of the

passive safety relief valves. Why?

MS. ANDERSEN: They don't meet the screening criteria. I don't believe they're credited in any of our design basis accidents or transients.

MEMBER STETKAR: Why does the plant have eight extra valves that it doesn't need?

MR. MARQUINO: They're credited in ATWS which is a special event, not design-basis accident.

MEMBER STETKAR: Okay.

MS. ANDERSEN: Thank you.

CONSULTANT WALLIS: So they're needed for ATWS?

MEMBER STETKAR: They're needed for ATWS.

But as far as the tech specs are concerned, if I'm operating the plant, I can go out there and gag those valves, weld them shut and I'm not violating the law. Is that correct?

MR. ANTHONY: Gary Anthony speaking.

(LAUGHTER.)

MEMBER STETKAR: No, literally I'm not violating the law.

MR. ANTHONY: Under tech specs, you're violating the ASME criteria for flow from a reactor vessel pressure vessel. You have to have a certain flow volume allowed under ASME Code on these lines.

That's how we get the number of valves needed to protect the vessel at 4,500 thermal megawatts -- same as protecting a boiler.

Under the power boiler code requirements under ASME, you have to have a flow volume available to release that much in case you have an MSIV closure and you're still putting out that much power.

The code requirements will do it. So what you do is you end up picking up the code requirements on valve tests at their specified interval under ASME Code relief valve testing requirements.

MEMBER STETKAR: Okay. But it only comes into code testing. So how often do you actually do the code tests on these valves?

MR. ANTHONY: On the old BWR plants, two valve bodies have to be pulled every 24 months, and all operators have to pulled and tested.

MEMBER STETKAR: Okay.

MR. ANTHONY: But I'm not sure what this plant's requiring.

MEMBER STETKAR: It just says the safety -- well, I know a little more about this than I'm letting on. It says the safety mode list settings for the safety valves are maintained in accordance with the IST in-service testing program.

According to this, I believe in the DCD Table 3-9-8 says the safety valve opening setpoint pressure is verified once every five years. So I can have them gagged for five years.

MR. ANTHONY: Gary Anthony speaking. I think that would violate the Code right up front. You wouldn't be able to ever gag them and bring the boiler up to speed because your ANI would not allow that. Your authorized nuclear inspector would be checking those documents.

MEMBER STETKAR: Okay. Thanks.

MS. ANDERSEN: All right. The next one I'm going to talk about is GDCS.

For GDCS, if you have a required injection branch line or an equalizing train inoperable, you have up to 14 days to restore it. And for all these that I'm talking about, if you have more than one inoperable, the action is to place the unit in the Mode 3 within 12 hours.

The surveillances for GDCS are to verify the pool level every 12 hours, the initiator continuity every 31 days --

CONSULTANT WALLIS: Why do you have to verify the pool level so often? And is it really going to change?

MS. ANDERSEN: Probably not. That's just the standard frequency that is used in the tech specs.

CONSULTANT WALLIS: Unless there's a leak or something.

CHAIR CORRADINI: I think Mike said it over here. I think this is a typical thing for shift change.

CONSULTANT WALLIS: Gives them something to do every time they come on -- they have to look at the pool?

CHAIR CORRADINI: Yes.

But I think a lot of things are checked on --

CONSULTANT WALLIS: They want to be sure they caught everything --

CHAIR CORRADINI: Yes, I think that's --

CONSULTANT WALLIS: That's fine.

MEMBER ABDEL-KHALIK: What do you mean by verifying initiator continuity?

MS. ANDERSEN: It's just verifying that essentially the circuit's made up is how I would put it.

MEMBER ABDEL-KHALIK: Does it have any effect on the squib valve?

MS. ANDERSEN: Yes.

MR. MARQUINO: This refers to the squib valve continuity.

MS. ANDERSEN: Right.

MR. MARQUINO: We can test that without initiating the squib.

CHAIR CORRADINI: Is that what that is? So this is redundant from the previous page then?

MS. ANDERSEN: Different system but same surveillance. Different squib.

CHAIR CORRADINI: Oh, different squib? This is this? So the ones we -- are only the ADS? Okay. Excuse me.

MS. ANDERSEN: Yes.

CONSULTANT WALLIS: This is just a reminder to check that the circuit is -- it's all there and continuous.

MS. ANDERSEN: Right. And there is a continuity monitor with an alarm too. So they would know it immediately if the continuity was lost.

CONSULTANT WALLIS: For the small current -- instead of a big one?

MS. ANDERSEN: Yes. You verify actuation on actual or simulated signal every 24 months. And you check that the flow paths are not obstructed every ten years.

MEMBER ARMIJO: That seems like an awfully long time.

MEMBER STETKAR: I wanted to ask about that.

The way it's written, in fact there are a total of 12 flow paths that we're talking about -- eight injection lines and four equalizing lines. I can satisfy the surveillance requirement in the tech specs by sitting idly by for ten years and once at the end of 9.99 years verifying that all 12 of them are open. Is that correct?

MS. ANDERSEN: That's correct.

MEMBER STETKAR: I could also do it on a staggered tech basis which is specified for other systems where for example over the course of a ten-year period I take an equalizing line and two injection lines -- one injection line from each of two different pools -- and check those. And then the next year I take another sample such that each individual line is checked once every ten years. But I get some pretty early warning if I have some flow blockage issues developing.

Why isn't the surveillance specified that way?

MS. ANDERSEN: I don't have a good answer

for that one other than that this was modeled after similar surveillances in the STS for like checking drywell spray headers, and that's the frequency at which those are checked for obstructions. And that's what we modeled this one after.

MEMBER STETKAR: This one bothers me a bit.

MEMBER ARMIJO: For such an important system, it seems like every ten years is really -- it's got to be easy to check this.

CHAIR CORRADINI: Well, I think I know where the ten years comes from. This is the integrated leak-rate test is ten years.

So is the default idea? This is a passive system-like containment and you do those every ten years? Where did the ten years come from?

I've got to turn to the staff on this one. Because the only thing that I know is a ten-year thing is the integrated leak-rate test.

MS. CUBBAGE: The thought I had in parallel to what you were just saying was the in-service test program I think would be in addition to the tech specs. So it's not like this is the only

MEMBER STETKAR: Perhaps I can elaborate a bit because I did a little reading on this.

The tech spec bases for surveillance requirement 3.5.2.4 state -- and I quote -- "The ten-year frequency for performing this surveillance requirement is based on engineering judgment. This frequency is acceptable because cleanliness controls provide a high degree of assurance that foreign material that could obstruct the GDCS lines will not be introduced into the GDCS pools, the suppression pool or reactor vessel."

So the written bases say it's engineering judgment. Don't try to derive it from any other source.

CHAIR CORRADINI: Okay.

MS. ANDERSEN: There are screens at the intake for the suppression pool for the equalizing trains. And there's also I believe screens at the top of the pool like the opening to the atmosphere half-screens so nothing could get in the GDCS pool.

should.

MS. ANDERSEN: Sure.

CONSULTANT WALLIS: So what are you looking for? Are you looking for solid obstructions or some things which somebody dropped in during maintenance and they somehow got there? Or are you looking for corrosion?

MEMBER STETKAR: A valve that doesn't work anymore.

CONSULTANT WALLIS: That's significant.

MEMBER STETKAR: Corrosion, valve bodies that fall apart.

CONSULTANT WALLIS: They must have some idea about how likely it is which might govern your testing period.

MEMBER ARMIJO: It seems like a long time.

CHAIR CORRADINI: I guess I want to ask the staff about it since this is a judgment call. And staff I assume is okay with this. I think it's --

MEMBER STETKAR: See, there's another way of meeting the test each line every ten years rather than testing all lines at ten years.

CHAIR CORRADINI: Correct. And there's --

MEMBER STETKAR: Over ten years, you test -- but each refueling outage -- each two-year refueling outage, you wind up testing two or three years -- two or three lines.

CHAIR CORRADINI: And they see it on a staggered basis every ten years.

MEMBER STETKAR: That's right. And that type of surveillance indeed in these tech specs is specified for other systems.

CHAIR CORRADINI: Yes.

MEMBER STETKAR: I don't have the example but I know they have because I've read them somewhere.

CHAIR CORRADINI: Go ahead.

MS. ANDERSEN: All right?

CHAIR CORRADINI: Go ahead.

MEMBER STETKAR: Another question I had though on GDCS is that for the Diverse Protection System signals, one of the LCOs says that if one ADS valve with Diverse Protection System is inoperable, I have to restore the Diverse Protection System initiator to operable status prior to entering Mode 2 or 4 from Mode 5. That means that I need to do it before I start up the next time.

There's a separate one that says one or more GDCS subsystems with one Diverse Protection System initiator inoperable, the same LCO applies.

Because they're not coincident, my interpretation is that I could have a DPS actuator for a GDCS injection squib valve and a Diverse Protection System signal for the pressurization valve both inoperable at the same time for as long as two years. Is that correct? If they went inoperable on the day after I started up from power, for example.

MS. ANDERSEN: That's correct.

MEMBER STETKAR: Okay. Any good basis for why I don't try to fix it while I'm operating?

MS. ANDERSEN: For the DPS, which is meant to mitigate common mode failures, we allow you to have one be inoperable essentially until you start up again because you still have enough operable DPS initiators to actuate the required number of systems. And if you have more than one out, then you've lost your ability to mitigate the common mode failures of the digital protected system because if you had a common mode failure, you'd have more than one that didn't work, and then you have less than your minimum number of systems working.

MEMBER STETKAR: But that's applied separately to DPVs and to GDCS injection valves.

MS. ANDERSEN: Yes.

MEMBER STETKAR: So I can have one and one out --

MS. ANDERSEN: Yes.

MEMBER STETKAR: -- for a long time. But I can't have two and zero.

MS. ANDERSEN: Right. In tech specs, we don't address all the different combinations that you could have across systems.

MEMBER STETKAR: Well, in some places you

do. For example in shutdown for these particular things --

MS. ANDERSEN: Right.

MEMBER STETKAR: -- you do.

MS. ANDERSEN: That's the one place --

MEMBER STETKAR: Don't do that.

MS. ANDERSEN: But for the most part, the different combinations of inoperabilities would be handled more with the risk assessment and your evaluation whether you're still in your design basis or not.

MEMBER STETKAR: I just wanted to make sure I'd actually interpreted the A and B and that they could both be out together for as long as two years is the maximum basically.

MS. ANDERSEN: Yes, that's right.

MEMBER STETKAR: Okay. Thanks.

MS. ANDERSEN: All right. For ICS, you can have an ICS train be inoperable for up to 14 days, have more surveillances on this system than the others. You have to verify the valves that are not locked, sealed or otherwise secured in position are in their correct position every 31 days. Verify nitrogen supply pressure, 31 days; initiator continuity again, 31 days.

We verify that the subcompartment manual isolation valves are locked open every 24 months. And that's to make sure the full volume of water is available to get you for the 72 hours.

CONSULTANT WALLIS: Why do you say that? Full volume of water. Is that on the list?

MS. ANDERSEN: No. That's an elaboration on the 4th bullet about the subcompartments.

CONSULTANT WALLIS: I was going to ask you about that but you've said it.

MS. ANDERSEN: You verify actuation on actual or simulated signal every 24 months. You verify each train as capable of removing the required heat load and that's every 24 months on a staggered test basis.

CONSULTANT WALLIS: How do you do that?

MS. ANDERSEN: Well, I believe this came up last time.

CONSULTANT WALLIS: You open some valves and you actually remove the heat.

MS. ANDERSEN: Right. We do have the surveillance. The frequency is such that you can perform at up to 25 percent power. You have to have it perform before you get to 25 percent so that you know it's working before you go any further. That

will set up the test conditions. There are temperature sensors that are in there and a differential pressure transmitter that may be used to develop the test but we don't have the test developed.

MR. MARQUINO: And you can also monitor the bypass valve position because we would perform this test with the bypass valves open and then when the IC begins removing steam, the bypass valves will shut so that change in flow rate will give us an indication of the steam flow to the IC.

MS. ANDERSEN: All right. The last one I'm going to talk about is PCCS. For a PCCS condenser being inoperable you have eight hours to restore it. The surveillances would be you verify these spectacle flanges for the event and drain lines are in their free-flow position. The surveillance is essentially done anytime that you have the opportunity to have entered containment.

You verify the subcompartment, isolation valves are locked open. This is similar to ICS. It's all the same pools, share the same water. You verify that there is an unobstructed path through the drain line and the vent line every 24 months on a staggered test basis for each condenser.

The last two are new. These are in Rev. 8

but not in Rev. 7. These have to do with the hydrogen issue. Every 24 months on a staggered test basis we will do visual examination on the vent catalyst module.

CONSULTANT WALLIS: What are you looking for?

MS. ANDERSEN: Just physical damage. Evidence of damage.

CONSULTANT WALLIS: Don't you need to look at the catalyst surface so you can actually inspect the interior of the module?

MS. ANDERSEN: Yes. That's what we will do. We are also going to verify performance of a representative sample of the catalyst every 24 months on a staggered test basis.

CONSULTANT WALLIS: You actually take them out and test them?

MS. ANDERSEN: Yes.

CONSULTANT WALLIS: Do you test the fans?

MS. ANDERSEN: They get tested by the ACM, the Availability Controls Monitor -- Manual. Excuse me.

CHAIR CORRADINI: So since we're here and we brought it up before, everything else is on a two-year staggered basis. Why wouldn't you test your GDCS

flow lines every two years, every train on a staggered basis? Let's ask it directly and then you can caucus. I mean, it seems to me all the other passive systems you're following this procedure and in the GDCS you could follow a similar procedure.

MEMBER ARMIJO: It's not completely staggered.

MEMBER STETKAR: Staggered. That is, in some sort of succession you capture all of them within every eight years or 10 years or something like that. There is one also on the IC PCCS pools. There is a surveillance requirement that says, "Verify each IC PCCS pool subcompartment as an unobstructed path through the moisture separator to the atmosphere every 10 years."

The basis for that is also frequency is based on engineering judgment because it's simple. I don't know what you do to verify that's open but I guess you can look to see that it's open. That is also not specified on a staggered basis. It could look at all of them once every 10 years. That's another of these passive things that I noted that wasn't specified on a staggered basis.

There is one strange thing. One time in my life I was a shift supervisor and spent too many

hours out of every day trying to figure out what particular tech spec I was violating and often times didn't figure it out correctly.

In the IC PCCS pools there is an LCO that says, "If one required IC PCCS expansion pool level instrument channel isn't operable, I restore the required channel to operable status in 20 hours. Or if one required IC PCCS expansion pool to equipment pool cross-connect actuation logic division is inoperable, I restore it to operable status in 20 hours."

I did a pretty exhaustive search through the tech specs and these are the only 20-hour LCOs in the entire tech spec. Everything else if I'm operating a plant, I'm thinking, my God, I have an instrumentation channel or an actuation channel inoperable. I have a 12-hour time clock. This is now setting me up as an operator to get really confused.

I read the basis and I sort of understand the rationale that it's the nominal 12 hours plus an additional eight hours to restore it to service before you have to start the shutdown. Why couldn't you make it just consistent with the rest of them? It would help me as an operator to think of things consistently. Is there a big deal that I need 20

hours for these instead of 12 hours?

MS. ANDERSEN: Normally if you have an instrument out of service you would declare it whatever is supported inoperable after 12 and then you would go to that specification which would give you the additional amount of time.

MEMBER STETKAR: Right.

MS. ANDERSEN: This gives you the same overall amount of time. It's just visually different because the instrument spec is embedded in the pool spec.

MEMBER STETKAR: I understand but you could have worded it differently that referred you to a second subset that said given that you fall out of the 12 hours you have eight hours additional. I can't argue that it's inconsistent with the philosophy of the other tech specs.

I can only say from an operational perspective everything else is consistent except for this one. It seems like you could easily rewrite this one to make it sound consistent without adding anything because it's all self-contained.

MR. HARBUCK: This is Craig Harbuck from the Tech Spec Branch. This unique construct is the result of getting close to the end of the review and

identifying an instrumentation function where they actually were missed. Instead of going back and revising instrumentation specifications since this is a fairly simple application that the instrumentation in these valves that connect these tanks, we elected to do it this way.

CHAIR CORRADINI: I understand that. I kind of read through the basis and the history. I understand why it is where it is. I'm just saying that from an operational perspective trying to understand how the tech specs are laid out I could have written this LCO such that if the instrument signal is unavailable, I have 12 hours to restore it to status, to operability.

If A is not achieved, then I fall to pick a B or a C or a D and you say you have eight more hours and then shut the plant down. That is sort of philosophically consistent with all of the rest of the text specs. I'm not saying put it back in the instrumentation.

I'm just saying kind of write it consistently. Think about the operations people, how they are going to read these things and try to abide by them. It achieves the same thing. It can stay by itself because of its unique little function. We've

spent too much time on this anyway. I've gotten my point across.

CHAIR CORRADINI: Point taken.

MS. ANDERSEN: All right.

MEMBER STETKAR: About the operators.

MS. ANDERSEN: In summary we've developed the ESBWR tech specs to meet the requirements of the 10 CFR 5036. They are generally based on BWR-6 standard tech specs. Where we had design differences we modeled our tech specs after the SPS systems that had similar design functions.

CHAIR CORRADINI: Further questions?

MEMBER STETKAR: Yes. The tech specs for the Diverse Protection System says, "If one or more -- and I'll emphasize "or more" -- required DPS functions are inoperable, we store the required DPS function to operable status in 30 days." Because it says "one or more" that tells me I can have the entire DPS out of service for 30 days. Is that correct?

MS. ANDERSEN: I would have to take a look at that one.

MEMBER STETKAR: It says "one or more."

MS. ANDERSEN: One or more functions?

MEMBER STETKAR: So one could be all. The quote is at Section 3.3.8.1, "One or more required DPS

functions inoperable." The LCO 8.1, "Restore required DPS function to operable status in 30 days." It doesn't say one DPS function. It says one or more. If it says one or more, I can pull the plug on it.

MS. ANDERSEN: That would be correct.

CHAIR CORRADINI: I'll ask the staff if that's okay. I don't want the basis for the 30 days. Disconnecting the entire system for 30 days --

MR. MARQUINO: It's a Diverse Protection System.

MEMBER STETKAR: I understand it's Diverse.

MR. MARQUINO: We still have the primary protection system available.

MS. CUBBAGE: Right. I think we would need to look back at the basis for how DPS ended up in the tech specs. Most of the RTNSS systems did not end up in the tech specs. There was one particular aspect of DPS that elevated it to RTNSS. We would have to look more closely at what is exactly in tech spec 4.

MS. ANDERSEN: I think it's the ICS and the GDCS. Is there one more system? ICS is not in tech specs for DPS. It's in the ACM. You're right, it was based on the risk.

MEMBER STETKAR: Before you close up shop,

squib valve functional testing is performed under the in-service testing program. I was curious what the frequency of the functional -- when I say functional testing, I mean actually fire the squib valve.

The only thing that I can find in the DCD is there is an in-service testing Table 3.9-8 and it says that, "The DPVs, the IC PCCS pool cross-connect, SLC injection, GDCS injection, GDCS equalizing, and GDCS deluge squib valves will be fired and replaced per paragraph ISTC-5260." What does paragraph ISTC-5260 tell me how frequently to do that?

CHAIR CORRADINI: You mean you couldn't find that?

MEMBER STETKAR: I have no idea what it is but I can quote it.

CHAIR CORRADINI: I'm disappointed.

MEMBER STETKAR: Do you have any information about how often that needs to be done?

MS. ANDERSEN: I thought it was you do 20 percent every refuel.

MR. HAMON: I'm not 100 percent sure here but if I remember correctly, they are supposed to change out the charging units, I believe, every four or every six years. Then every time they change them out you're supposed to take them out and go test them

to make sure they still function.

MEMBER STETKAR: Out of curiosity could we clarify that?

MS. CUBBAGE: How about if we catch that in Chapter 3?

MEMBER STETKAR: Um?

MS. CUBBAGE: How about if we catch that in Chapter 3.

MEMBER STETKAR: In 3?

MS. CUBBAGE: You said it was in Chapter 3.

MEMBER STETKAR: No, it's Table 3.9- -- oh, I'm sorry. It's an in-service testing table so, yeah, it is in Chapter 3.

CHAIR CORRADINI: Hold that thought. Okay. Any others for Sara?

Hearing none, thank you.

Staff.

Leslie.

MS. PERKINS: My name is Leslie Perkins and I'm the project manager for Chapter 16 Technical Specifications. The review for Chapter 16 is based on DCD Revision 7 and the applicant's RAI responses. The purpose of the presentation is to brief the subcommittee on the staff review of Chapter 16 of

ESBWR DC application. I'm going to describe their resolution of significant open issues presented back in 2007 and answer any of the committee's questions.

With me is Craig Harbuck. He was the lead technical specifications reviewer. Also on this slide is a list of other technical reviewers from various branches in NRO that supported him in the review.

MR. HARBUCK: I'm Craig Harbuck and the outline of my short presentation is briefly just to describe the criteria by which we did the review. We'll discuss a few resolution of a few open issues that we anticipated would be of interest to the subcommittee. Then the conclusion and questions.

The criteria are basically to make sure that we're satisfying the requirements of 50.36 and 50.36a and we conform to the SGS conventions on format and usage rules and that we're consistent with the design and analysis for ESBWR.

First open issue that I would like to discuss has to do with COL information. As you all are very familiar with by now, we developed ISG-8 toward the middle-end of 2008. Part of implementing that and learning how to do that was done in the context of this review and also the review for North Anna and now Fermi.

The ESBWR DCD is unique among the design centers in that they have taken what has normally been a reviewer's notes that you find in various locations in the tech specs and bases that describe how you implement optional or plant specific type requirements.

Since that sounds a lot like the COL information item, they've taken all of the reviewers notes out of the tech specs and they made a table in the introductory part of Chapter 16 in the DCD that provides guidance to COL applicants on how they need to complete this information, site-specific information.

With the development of ISG-8 we determined that all those items had to be completed in time for the COL to be issued. There were three options in that guidance and the third option which was to remove information that you could not provide explicitly in time for the COL application and modify it by having an administrative program in the tech specs which require you to determine that information using an NRC-approved methodology.

In the case of ESBWR we've more or less implemented that with minimal action needed by the COL applicant in two cases. One, for the instrumentation

settings, the limiting safety-system settings, we established a set-point control program and the surveillance requirements that have to do with checking and verifying setpoints reference the set-point control program so there is a tie back to the LCOs.

Then the methodology that GEH submitted has been reviewed by the staff and a few issues were raised and have been resolved. My understand is that the I&C Branch has accepted that methodology now. The only COL item for the applicant to complete would be to put in the reference of the approved methodology.

The other area that we needed to apply this option 3 was with the post-accident monitoring instrumentation. During the course of the review the ESBWR application committed to follow Reg Guide 1.97, Revision 4. The key difference between that revision and previous revisions is that the determination of the instrumentation for post-accident monitoring is based on emergency operating procedure requirements and abnormal operating procedure provisions.

Those things can't be completed until after the COL is issued. That's something to do later on. We discussed with ESBWR applicant how to handle it. Maybe you can give us a bounding list of

instrumentation but you would have to convince us it was bounding. Or we could simply establish a program that would require you to follow Reg Guide 197 Rev. 4 to establish this list.

Since there was already a discussion in the FSAR that listed and described all these instruments, a lot of that information which normally would have been the bases it's all there and the establishment of the program will allow COL applicant to essentially do a confirmatory analysis with the list that's already in the FSAR and we would still be satisfying the requirements according to the support of our legal staff, the requirements at page 36.

That's a little more detail than I expected. Any questions? Okay.

Now, the next slide is presented because at the last briefing we still had a very uncertain basis for what surveillances we were doing, what frequencies they would be performed at and how we would do these surveillances.

The first point I want to make is that the instrumentation is divided up into two parts, the instrumentation functions on the left and actuation functions on the right. The dividing line is more or less the digital trip module and it varies a bit from

exactly where the boundary is depending upon which system you're talking about. Essentially everything from the sensor up to the digital trip monitor is considered instrumentation function equipment. The actuation functions go down to load drivers.

Now, at that time of the last briefing there was a proposal on the table from GEH that we would have much longer surveillance intervals because we would be relying on the self-diagnostic features of the I&C equipment. The tech staff did not find sufficient detail in the information to make a judgment about whether that was acceptable or not.

We could not come up with a reason to accept that. Since three-month frequencies in the standard tech specs were only acceptable to staff if there was a supporting topical report which is largely based on operating history and the statistic derived from that, we dropped back to a 31-day frequency for channel functional tests.

MEMBER STETKAR: This caught my eye because, as best I can tell, most other applicants have 92 days for their channel functional tests. In this particular case the SER says that for reasons that are lot elaborated very well the staff requested GEH to take the following actions; revise the channel

functional tests, surveillance frequencies of 92 days to 31 days.

This is something that you imposed on GEH that doesn't seem consistent with things you've accepted for other current operating plants, other new plant applications, and other design centers that are currently under review. I'm really curious why you're beating up GEH with a 31-day functional surveillance interval for this. It seems pretty onerous.

MR. HARBUCK: It came down to did we have an adequate basis for it. You'll find in tech specs that sometimes for different numbers for frequency, for example, you can find identical wording for why it's acceptable. Same thing for completion time.

In this case it's clear that in the standard tech specs for BWR-6 that if you're an operating plant and you haven't proposed an amendment to change your frequency to 92 days for channel functional tests, you're going to have a 31-day frequency if you don't have a topical report that has been reviewed and approved by the staff.

Since there was no topical report for this instrumental system that is being proposed, the best way to resolve the issue was to simply take the conservative approach and say, "Okay, 31 days we'll

base it on the reliability or the asserted reliability of instrumentation," with the thought that at some point in the future when sufficient data or analysis has been presented to the staff to justify a longer time, then certainly a longer time could be granted.

CHAIR CORRADINI: So maybe you guys know but I'm not sure. What is in this topical report that would be expected to lengthen the time?

MR. HARBUCK: I think part of the problem was that the level of detail regarding the design of the system, the platforms and that sort of thing, it was insufficient for the staff to make any conclusions about relying on this information. It's really that simple.

MEMBER STETKAR: Did you have a similar topical report for the ABWR when that design was certified because I'm staring at ABWR tech specs right now and they have 92 days in their functional tests.

CHAIR CORRADINI: Did you guys become smarter or just more conservative? Let's ask it that way.

MR. HARBUCK: I was not involved in the ABWR review.

CHAIR CORRADINI: Well said.

MR. HARBUCK: And the page-and-a-half SER

for the tech specs, for the design cert, failed to cover that point. I can only speculate as to how that happened.

MEMBER STETKAR: I know we're talking about ESBWR now so it's not appropriate to talk about other current design centers.

CHAIR CORRADINI: It's not fair to.

MEMBER STETKAR: It's not fair to.

MEMBER ARMIJO: Well, it is appropriate to talk about consistency, the staff being consistent in requirements be placed on different designs. That's really the heart of the question.

MEMBER STETKAR: The message I'm hearing for here for consistency with other design centers that are currently --

CHAIR CORRADINI: We don't demand consistency in our deliberations.

MEMBER STETKAR: -- is that we should expect to hear that they've submitted a topical report to justify the 92-day surveillance or other technical justification. Otherwise, their tech spec should say 31 days.

MEMBER ARMIJO: If that's a requirement, then everybody understands it.

MEMBER STETKAR: You know, it's perhaps a

bit unfair to look back at ABWR 17 years ago.

MR. HARBUCK: I guess the dilemma that the Tech Spec Branch has is we like where possible to establish a clear reason for why something is the way it is. Too many times there isn't a real clear starting point or basis for why something is and we just kind of grandfather it.

In this case we are establishing a clear statement that at 31 days based on reliability if you want more, feel free to give us the information that we need to justify it. That was I think the easiest way to resolve the issue.

CHAIR CORRADINI: Keep on going.

MR. HARBUCK: On channel calibration, again the focus is on the analog part of the instrument and the setpoint comparison and you perform the channel's functional test as part of it.

Now, the next slide is the same slide but I have additional notes for the right-hand column. Two slides. The logic system functional test applies to actuation functions only and it includes things such as timers, trip logic units, output logic units, low drivers for MSIV actuation functions, for example.

It overlaps into actuation testing. There had been a proposal on the table to have this done on

a staggered task basis but, again, there was no basis for it and there was no precedent for it so we changed it. The 14-month frequency is what we normally state for this kind of test in the STS.

Response time testing. There are response time tests for both types of instrumentation. That's what are listed at the bottom there. They test different parts of the system obviously and they overlap so that you get the entire response time. The criteria for the response time is typically found in DCD Chapter 15.

Going back to the COL item we mentioned earlier, the resolution of that issue, a good number of the COL items involve optional allowance to use allocations instead of actually doing measurements or some instrumentation functions or components.

Again, you need some topical report or some other technical basis to support that and this is left as an option for the COL applicant. By judging from what North Anna submitted and what Fermi has now submitted no one is opting to try and use allocations at the moment but perhaps at a future time they might.

Anymore questions on the instrumentation?

The next issue I thought might be of interest was this concern that we initially had about

testing or measuring the drywell and wetwell bypass leakage as a total quantity. Originally it was proposed just to measure the leakage through the vacuum breakers themselves.

We ended up with these three surveillance requirements and the last one is the one that addresses the overall leakage. That surveillance determines the effective overall suppression pool bypass leakage area to ensure that the leakage paths that would bypass the wetwell pressure suppression function are within allowable limits.

The last item I would like to bring up, and I think we've touched on it today already -- do you have a question?

CHAIR CORRADINI: We'll wait.

MR. HARBUCK: Okay.

CHAIR CORRADINI: We'll wait. I'm sorry.

MR. HARBUCK: Control room habitability area temperature post-DBA. Essentially refer what the heat sink temperatures are by what the average air temperature is in the space surrounded by the heat sinks. The acceptance criteria and the heat-up analysis associated with this issue are evaluated in SER Section 9.4. I think there were some meetings over the summer that went into this in some detail.

MEMBER STETKAR: We had some questions, if I recall, about how you actually determine the temperature of the heat sinks.

MR. HARBUCK: This is one of those issues that kind of cuts across. Just quoting from the bases, the surveillance requirement says, "Verify heat sink temperature within established design limit." What you have back in the bases it shows you what the average air temperatures are if you're assuming an equilibrium between the air and the heat sinks. This would be the starting point for the analyses.

The different numbers have to do with the different locations of the rooms. Not all the rooms are right next to the control room. All the rooms in the building, control building, have an impact on this to some extent. The key one is for the control room habitability area, the main control room, at 74 degrees.

The analysis that has been performed, to my understanding, shows that the passive heat sinks will limit the main control room average air temperature to about 93 degrees Fahrenheit for the 72-hour period in which you have no forced ventilation or cooling.

MEMBER ARMIJO: Is that 74 degrees the

surface of a wall temperature or at a certain depth within the wall?

MR. HARBUCK: That's the interesting part. Exactly how it's measured and determined is something that is the subject of procedures. The thought is that it is the bulk average temperature of the room of the air. After a certain period of time you would have an equilibrium of sorts with the heat sink so you would expect the heat sink would be starting out at that temperature.

MEMBER ARMIJO: Right now it's just air temperature in the room?

MR. HARBUCK: Yes. That is how it's done. Now, this doesn't rule out some other method of trying to ascertain the concrete temperature but, again, that's something that needs to be worked out through testing and as a matter for procedure writers.

MR. MARQUINO: If I could interject, this is Wayne Marquino.

These average air temperatures are consistent with the initial condition of the heat-up analysis. So considering that concrete has a long-time constant -- something like 12 hours -- if you're maintaining the air temperature continuously below this value, your initial concrete temperature will be

lower and therefore lower than the assumption in the heat-up analysis. So that is the justification for monitoring the average air temperature.

MEMBER ARMIJO: It'll change over time. The outside temperature that -- a lot of things are changing.

MEMBER ABDEL-KHALIK: You said that if you expect if you maintain air temperature at or below 74 that the concrete temperature will be at or below that 74?

MR. HARBUCK: For that heat -- it is.

MR. MARQUINO: Yes. So we're specifying here --

MEMBER ABDEL-KHALIK: So if the ground is 100 degrees and heat is flowing into the control room through the wall, the concrete temperature will still be 74 degrees?

MR. MARQUINO: Yes. We have a ground temperature that was assumed in the analysis also. But the intent of this LCO is that we are maintaining the initial conditions assumed in the heat-up analysis and that the concrete temperature is an important parameter.

Now this part of the LCO does not monitor the concrete temperature. It monitors the air

temperature. But by keeping the air temperature below these values because the air is in contact with the concrete, it will maintain the concrete temperature below the initial temperature in the heat-up analysis.

CHAIR CORRADINI: What was the temperature in the heat-up analysis that you assumed? I don't remember it.

MR. MARQUINO: We initialized it with these air temperatures. So we have CONTAIN model of the reactor building and the control room. We initialize it to a steady state with air temperatures in the concrete because there's some concrete walls that are in between two different air temperatures. So basically, it'll initialize at an average temperature between them.

MR. HARBUCK: I believe this topic is going to be discussed at a future presentation. Is that right?

MR. MARQUINO: No. We've covered it.

CHAIR CORRADINI: We covered the control room analysis just in June and then details in May.

MEMBER ARMIJO: I think this question came up then.

CHAIR CORRADINI: Yes, we settled it.

John, you had another question?

MEMBER STETKAR: Well, yes. I just thought of something though. I'm sorry.

There are areas in the reactor building that contain the safety-related uninterruptible power supplies, the batteries, AC and DC power distribution cabinets, some DCIS cabinets and remote shutdown panels. They're normally cooled by the reactor building clean air HVAC subsystem. But that's a nonsafety-related system, right? Those areas are also cooled passively during your design basis accident.

We've focused an awful lot on passive cooling of the control room and the control building. All of these specifications here focus on that part of the plant. I didn't look for and quickly searching here, I couldn't find similar specifications for those areas out in the reactor building which could be just as susceptible to heat-up and have similar passive cooling requirements.

You're more familiar with the tech specs than I am. And I didn't go search for them. That's why I said I just thought of this right now. Because that's the other area of the plant where I'm concerned about passive cooling.

MR. HARBUCK: Well, all that I can think to say about that is that equipment qualification-type

requirements would apply in those situations. And it must have been demonstrated that post-accident, the equipment you were mentioning would be able to survive.

MEMBER STETKAR: Well, but I mean the same could be said for the main control room.

MS. CUBBAGE: Well, except for humans.

MEMBER STETKAR: The main control room --

CHAIR CORRADINI: Take the human element out of the --

MEMBER STETKAR: GDC-19 is the same --

MR. HARBUCK: That really drives the control room, I think. But also equipment qualification.

And I'll have to defer to GE to --

MEMBER STETKAR: Let me ask GE. Why aren't there similar LCOs for temperature to assure that the areas out in the reactor building will remain cool during the same nominal passive heat removal scenarios? It's the same scenario mostly.

CHAIR CORRADINI: Can I just --

MEMBER STETKAR: In fact, they have larger heat sources too. I mean, there's -- out there.

CHAIR CORRADINI: But if I can just back up a minute?

So I guess I don't understand. Having just walked through Columbia Station and it was hot as a pistol under normal operation, I would think it's a totally different ball game out in the --

MEMBER STETKAR: Yes, I'm not going to assume. I've been in plants that are pretty cool out in the reactor building. This is not Columbia Generating Station.

CHAIR CORRADINI: I understand.

MEMBER STETKAR: These areas of the reactor building don't look like Columbia Station. They're nice, clean areas. They just happen to be in a train station.

CHAIR CORRADINI: No. What I'm trying to get at is I'm not sure what you're asking from the applicant in this case because once I get outside of a controlled area such as a control room, are there tech specs that have the auxiliary building temperatures?

MEMBER STETKAR: Yes. Because in active plants, there are tech specs that require operation of safety-related ventilation systems that keep those auxiliary building rooms cool whether they're equipment rooms or whether they have switchgear in them or whatever they are.

CHAIR CORRADINI: Okay.

MEMBER STETKAR: So certainly, yes, there are.

This plant does not have tech specs on active ventilation systems because there are no safety-related active ventilation systems.

This LCO, for example, that we're staring at at the board here is in lieu of the tech spec that says control room ventilation systems shall remain operable. It's a de facto temperature such that the passive cooling requirements will be met.

CHAIR CORRADINI: And you're saying there's no --

MEMBER STETKAR: I can't find one for the reactor building areas that contain safety-related equipment. In fact, they're the power supplies for all of this stuff. It's pretty important to keep them operating. And they're big heat generators. So I'm curious.

But I didn't go looking for them in particular. I didn't read every line in the tech specs. And I didn't even think of it until --

MEMBER ARMIJO: So someone had to analyze what the temperatures would be so the equipment would be qualified to operate in those --

MEMBER STETKAR: The same as they did

though for the control room.

MEMBER ARMIJO: Yes.

MEMBER STETKAR: But you still specify that ambient temperatures shall be maintained below these limits such that when the active ventilation systems disappear, you still need that EQ limit. So, yes.

MEMBER ARMIJO: I agree.

MR. HARBUCK: There was a point in one of the revisions where because they were proposing a different kind of battery, they were proposing room temperatures as being the thing that you would measure to assure --

MEMBER STETKAR: Yes, but they went away from batteries.

MR. HARBUCK: And they went away from that. But again, there was no active cooling or ventilation associated with that.

And that was actually when -- these initial temperatures that you're worried about same as here.

MEMBER STETKAR: It's analogous in my mind. It's an analogous situation that you must assure -- there should be a room -- a passive room heat-up analysis for those locations with some

initially-assumed conditions such that at the end of 72 hours, you still meet the temperatures for the equipment in those locations.

So I'm curious if there's a reason for why there isn't an analogous specification for those locations in the reactor building. I'd like to know why there isn't.

I'm not asking you because it's GEH who proposed the tech specs.

MR. HARBUCK: But it's perhaps -- I mean, if showing the temperature will not rise above a certain point is a critical aspect of operability or requirements for the uninterruptible power supplies, then maybe you've got a good point.

But Amy, which chapter would be the one that would address ventilation systems in the reactor building?

MS. CUBBAGE: Nine.

MR. HARBUCK: Chapter 9. And that's already --

MS. CUBBAGE: That's not done yet.

MR. HARBUCK: Chapter 9's yet to be done?

MS. CUBBAGE: Yes. Next month.

MR. HARBUCK: And you're sure they're not going to discuss this issue again? My understanding

from Mr. O'Driscoll is that they would. It would come up again.

MS. CUBBAGE: Well, Chapter 9 is coming back to the Subcommittee. And if we need to, we can make sure we discuss this issue.

MR. HARBUCK: Okay.

CHAIR CORRADINI: Okay. The point is taken.

MR. HARBUCK: The point is taken. And we'll make sure --

CHAIR CORRADINI: Keep on going.

MS. CUBBAGE: So normally in an operating plant, they have tech specs for ventilation in the reactor building?

MEMBER STETKAR: Absolutely. Go to Liebstadt, for example. Liebstadt is BWR-6. And it's got -- the safety-related --

CHAIR CORRADINI: Hold on.

MR. HARBUCK: There are requirements for temperatures such as in the drywell and that sort of thing.

MS. CUBBAGE: That's different.

MR. HARBUCK: But the secondary containment and/or the reactor building -- whatever you want to call it -- I couldn't speak real clearly

about that, or for certain.

MS. CUBBAGE: I just did a quick search and I found drywell containment. I didn't see any reactor building ventilation-type specs.

MEMBER STETKAR: It depends on -- most plants -- currently operating plants don't have a lot of this type of equipment in the reactor buildings. So for example, you'll see specs on ventilation for example, low-pressure coolant injection rooms. If you look at the system, in the corner rooms for current BWRs, you'll find under the tech specs for high-pressure coolant injection or reactor core isolation cooling, the requirement that ventilation shall be operable for those rooms. Because most currently operating plants, most of the stuff that's out there is mechanical safety-related systems.

MS. CUBBAGE: Maybe it's in the bases. But I'm not seeing any ventilation specs of that nature.

MR. HARBUCK: Well, it's not going to be in the ESBWR.

MS. CUBBAGE: No, I'm in standard tech specs.

MEMBER STETKAR: Oh, standard tech specs? Well, maybe they didn't think about it because BWR

standard tech specs might have been written for the current operating fleet that don't have this type of configuration.

MS. CUBBAGE: They are. BWR standard tech specs -- when I say that I mean BWR operating the BWRs. Yes.

MEMBER STETKAR: And it would be unusual in the operating fleet to have this type of configuration with safety-related electric power supplies and some instrument control cabinets out in the reactor building.

CHAIR CORRADINI: Would it be the same thing --

MEMBER STETKAR: BWR-6s however do.

MS. CUBBAGE: That's what I'm looking at.

CHAIR CORRADINI: The same thing you just said would apply to ABWR. One wouldn't expect to see it in the ABWR either? Because I couldn't find it.

MEMBER ARMIJO: ABWR is more like a standard plant.

MS. CUBBAGE: I guess my point is --

CHAIR CORRADINI: The point is taken. Let's move on.

MS. CUBBAGE: Okay.

MR. HARBUCK: So with those examples --

and there are others -- but those are the ones we thought you might be interested in.

We have reached conclusion that the tech specs satisfy the regulations, and they're therefore acceptable.

Now if you have other questions, we can jump into those.

CHAIR CORRADINI: John?

MEMBER STETKAR: No.

CONSULTANT WALLIS: I'm a bit curious. We just heard a presentation by GEH -- Sara Andersen. And then we had a presentation from you which apparently has the same title but seem to be utterly different. Usually the staff presentation says something about what they think about what GEH just said.

Do you disagree with what GEH said?

MR. HARBUCK: Well, the bulk of the GEH's presentation was dealing with the actions and surveillance requirements for passive systems. And when we met with you in March of 2008, we went through the surveillance requirements for the passive safety systems quite a bit. And they've changed a bit since then, but it was in a way a review of what we already sort of discussed before except this time we had a

better bases or reasons for what we chose as the action requirements which we didn't have any of that before.

And surveillance requirements -- all that as you may recall was based on some yet to be created probablistic analysis and we want back to the deterministic approach on determining these limits. So --

CONSULTANT WALLIS: That means engineering judgment?

MR. HARBUCK: Engineering -- precedent. It's what standard tech specs has. You look at all the various ways of performing a function, that can inform deterministically whether a three-day AOT is needed or in this case, it indicates 14 days.

The passive safety systems are a bit different. It's not like you have two 100 percent trains. You've got a system that suffers a bit of degradation and still meet what the action analysis assumes. My understanding is that if one injection line, one equalizing train for the GDCS, you can have two of those, not provide flow and still meet all your accident assumptions.

The issue about the ten-year time period, I can't say specifically which part of the STS we were

looking at. But generally checking for obstructions or that a pipe is free of obstructions is a fairly long interval because you have these other controls like cleanliness and that sort of thing.

And also, something I would just want to mention about that is that the IST program requires every cycle that every line gets flushed. And so in a sense, you're already doing that surveillance all the time.

But the other thing to remember about surveillance requirements -- not just the frequency but the fact that to be an LCO, you have to make the surveillance requirements. You always have to make the surveillance requirement. And so if you have any reasons to suspect that you're not meeting it in between performances, then you have to take appropriate action.

MEMBER ARMIJO: Is that IST really applied to these pieces -- these lines that you're --

MR. HARBUCK: The GDCS -- well, I don't know about the --

CONSULTANT WALLIS: Not an end to end --

MR. HARBUCK: I don't know about the ECCS condensers, the path through those. I'm not sure that's in IST. But it certainly there for -- the IST

certainly covers the GDCS.

CONSULTANT WALLIS: So this ten-year issue is not unimportant. It's already been covered. Why not just wait?

CHAIR CORRADINI: Why not stagger it?

MR. HARBUCK: That's a good point. That could be done. There's no reason not to.

CHAIR CORRADINI: Would it be preferable? I mean, given that so many of the other passive systems are staggered in their testing so you're testing a part of the train, you're always testing at some frequency all the time.

MEMBER STETKAR: But if there's some sort of common degradation that gives you early warning, for example.

MEMBER ARMIJO: You may not find blockage. You could find something else.

MR. HARBUCK: That's an easy fix. A lot of times what we end up doing in tech specs is simply adopting a good practice that a plant has been doing. This would sort of fall into that. Because I imagine a plant would probably not try to do all this at once but do one every refueling.

CHAIR CORRADINI: Yes.

MR. HARBUCK: So I supposed we could leave

that with GEH to think about if they wanted to add some staggered testing to some of these kinds of surveillances.

CHAIR CORRADINI: Okay. Other questions?

(No audible response.)

CHAIR CORRADINI: If not, thank you very much. And we'll go around the table to get final thoughts by our consultants and members.

Dr. Kress?

CONSULTANT KRESS: It's been a long day.

CHAIR CORRADINI: Really?

CONSULTANT KRESS: Generally, it looked like most of the open issues were appropriately closed to me. I think that was pretty good.

I just had a few comments.

With respect to the site characteristics, we were told they replaced one stack with three, the chi over Q. And to get the chi over Q, they add the three. I don't think that's the appropriate way to deal with atmospheric dispersions. But it's probably conservative.

I was a little taken back by the sine wave diurnal temperature distributions and how they were dealt with. I'll have to think about that some more. But it looked a weird to me. It may be all right.

I had a question during the human elements about how you get a RAW and Fussell-Vesely to get the significance of human error. I had a little side conversation with a fellow who educated me on that. I think it's all right. It's the standard process. You have these things in fault trees and event trees, and they have so much time to get it done. And they have a human element model depending on the environment. And that's about the only way you can get it down because you can't have really a database on the frequency of failure. So I think that was all right.

I like the ESBWR on limiting contamination. I thought that was a good way to do it. And I was glad to see they didn't have any underground piping. So that was good.

I was surprised that they're going to use portable CAMs to measure radiation monitoring in critical areas. Sounds like a good idea. But I don't know how you assure that the right CAM is always in the right place if it's portable. But I guess you can put controls on that.

And we were filled in on the level of decay heat that we had a question on before. And we were told that this was the maximized level. I have no reason to believe it's not true, but I don't think

we were given the basis for it and we need to hear some more about that. It may be true. But I didn't have any reason to believe it wasn't. But I think we need to hear some more on that.

But other than that, that's the comments I have.

CONSULTANT WALLIS: I would just add that I would iterate that I think this dry bulb, wet bulb discussion was very unsatisfactory and needs to be sorted out.

The decay heat too is a little puzzling to me because when you shut down a reactor, you've got 30 megawatts there. And there must be some way that you have to take account of how that decay is before it's put in the pool. So that probably can be cleared out easily. But it needs to be cleared up so we understand the basis for that number that's being used.

Otherwise, most of this is just tidying up. That is I think on the right track with everything else except of course I'll defer to John on some of the points that he raised throughout the day.

CHAIR CORRADINI: Sam?

MEMBER ARMIJO: Yes. I agree with what Tom and Graham said.

The only thing that I'm still puzzled -- apparently we resolved this issue of the heat sink temperature for the wall on the control room habitability. I'd like to talk to my colleagues on how that got resolved because that's puzzling to me how you can count on that without some sort of measurement or a very good analysis and plant-specific, site-specific or something. So that's still puzzling.

That's all.

CHAIR CORRADINI: John?

MEMBER STETKAR: I've said enough already.

MEMBER ARMIJO: I like the material stuff -- the double-wall piping, the use of chrom-moly in the feedwater system, instead of relying on monitoring, they just solved it with a good material.

CHAIR CORRADINI: John?

MEMBER STETKAR: I don't think it's worthwhile for me to reiterate all of the items that I brought up.

CHAIR CORRADINI: I think there's one that I was hoping you'd bring up.

MEMBER STETKAR: I will.

CHAIR CORRADINI: Okay.

MEMBER STETKAR: I was going to say, about

the only thing from a licensing perspective, the concern that I have about how to find rule --

CHAIR CORRADINI: That's the one.

MEMBER STETKAR: -- a specific numerical screening criterion that may not have good technical justification for this generation of nuclear power plants. That bothers me a bit because it sets a legal criterion that then can be used as a basis for not doing the types of analyses that should be done to evaluate potential risks in PRA space or potential hazards in a safety analysis space from a wide variety of potential site-specific external threats. I think we need to think pretty carefully about that.

CHAIR CORRADINI: Okay. And just so I'm clear that I got you to agree to write that up in some fashion so I probably understood it --

MEMBER STETKAR: There's a couple things here for -- that being one.

CHAIR CORRADINI: Okay. Said?

MEMBER ABDEL-KHALIK: I really don't have much to add beyond what's already been said. But the idea of having an ITAAC to verify the passive cooling capability of the control room is a good one given the uncertainty in the modeling. So that would be some --

CONSULTANT WALLIS: Are you looking for a

test?

MEMBER ABDEL-KHALIK: Right.

MEMBER ARMIJO: Just turn off the air conditioning and sit tight.

MEMBER RYAN: I would second all the comments that were made about the monitoring with one addition. I think I wouldn't want to choose between fixed and mobile monitors. They both have their function. They both have their place. And my view is the portable monitors are great for ad hoc work and now are sophisticated enough, you can get even radon corrections during the workday if you want for radon build-up and decay over diurnal cycles. So they're pretty good and they do a really nice job of locating anything that's going on with the work.

The fixed monitors on the other hand give you something to trend over time -- even long periods of time -- a long-term, transient behavior of the plant.

CONSULTANT WALLIS: Why do they have to be so big? Can't they make them with the new technology so you can move them around quickly?

MEMBER RYAN: You sure can. It's a whole lot easier to have a few in fixed locations that are on the routine way. And the portable ones can do all

that mobile stuff pretty easy. So I think they both have their function.

The second area which I think is a real big improvement is to hear about the same sort of material questions that Sam raised about the piping instead of underground piping and really dealing with liquid effluents in a way that's not ultimately going to be a headache down the line at decommissioning or for further operations. So three cheers for that.

The other is that I would have liked to hear just a little bit more about what the plans are for waste storage and waste management if there is no eventual disposal facility available because that could become a bigger issue than not if they do have to have longer periods of storage of waste on site. There's some NEI guidance and other things that help address that. But it would be nice to hear a little bit more about how that's got to be addressed.

That's all. Thank you.

CHAIR CORRADINI: Okay. So I didn't have anything else to add to what I've written down from the members. But I did have a few things that I wanted to make sure I'm on the same page with.

John, you're going to have an action item to get us something on the generic issues relative to

the screening criteria that you were concerned about.

GEH had essentially -- I think Wayne wanted to -- will get us some details as to the basis by which this decay heat is a maximum.

MR. MARQUINO: Yes. I did get a little more information. If you have a minute after the meeting --

CHAIR CORRADINI: That's fine.

MR. MARQUINO: -- I can go over it with you.

CHAIR CORRADINI: Okay.

And then beyond that, I didn't hear anything so I'm paraphrasing here because I'm trying to write a summary that I'll send out to everybody as we did the last three Subcommittee meetings. But we're getting close to the end so I'm trying to write a summary out. I didn't hear anything that was of what I'll call a show-stopping concern, but a number of little things which I'll try to document chapter by chapter as we have it.

The only other thing I guess that's kind of left is this testing. There was the staggered testing relative to passive safety systems where we saw it in some cases where we didn't see it in others. And also, the only open item that again I don't view

as show-stopping but on the other hand John brought it up and I didn't see anybody answer him yet is temperature limits is a surrogate for ventilation tech specs for safety-related equipment outside of the --

MEMBER STETKAR: In safety-related areas outside --

CHAIR CORRADINI: -- safety-related areas.

MEMBER STETKAR: In the reactor building in particular.

CHAIR CORRADINI: Yes. In the reactor building.

MEMBER STETKAR: That's I think the only other location that has safety-related issues.

CHAIR CORRADINI: And I think that's something that we have to clean up and get clear about.

MEMBER STETKAR: And I don't know whether that's a Chapter 9 issue.

CHAIR CORRADINI: Well, we're going to have Chapter 3.

MS. CUBBAGE: We're going to have 3 and 9 coming up so we will cover it.

CHAIR CORRADINI: But I will write a summary which I will then share as normally, first with Chris, to make sure that I'm not off in some sort

of space land, and then with the members -- right -- and with Amy. And of course, I will wait to get the wonderful prose from the consultants to include. Okay?

With that -- did you have a question?

MS. CUBBAGE: No, I was just going to reiterate on your summary there so that issue that was just discussed now with the temperature in the reactor building, we'll hit that in September with Chapters 3, 6, 9 -- well, really 3 and 9.

The squib valve IST was brought up. We can cover that in Chapter 3 next month. We can cover the issue of the heat sink temperature for the control room next month if you'd like. I heard several people mention that one.

CHAIR CORRADINI: That's part of 3 also, is it not?

MS. CUBBAGE: The 6 and 9.

CHAIR CORRADINI: Sort of a 9 thing more.

MS. CUBBAGE: And then hopefully we can cover the decay heat issue now.

And I guess I'd look for direction from you if you want us to do more with the temperature swings or just leave it alone.

CHAIR CORRADINI: And just to make sure

the Subcommittee remembers, we now have a meeting -- full-day meeting -- Subcommittee meeting on the 5th of October. And we're viewing that as a spare for things that will bleed out of September 23 and 24 that may have to be covered prior to the full committee were the complete FSER and --

MS. CUBBAGE: There are some things we know will be October 5th. The Committee had requested a briefing on the staff's inspection of aircraft impact and also a voluntary presentation by the applicant on aircraft impact. That will be October 5th because the inspection will be complete in time for the September meet.

And also, due to the time line for resolution of the hydrogen issue, it's like that will be October.

CHAIR CORRADINI: Yes, I'll just remember everybody, the one open item on the hydrogen issue is we still don't have clarity as to isolation condenser performance. And there are some RAIs that are being answered or just have been answered and staff is looking at it.

I think that's everything that I have.

So I owe you all a summary pending comments from any of you that want to write them down

beyond the consultants who will write them down. Okay?

With that, we're adjourned. Thank you.

(Whereupon, at 5:14 p.m., the hearing was adjourned.)

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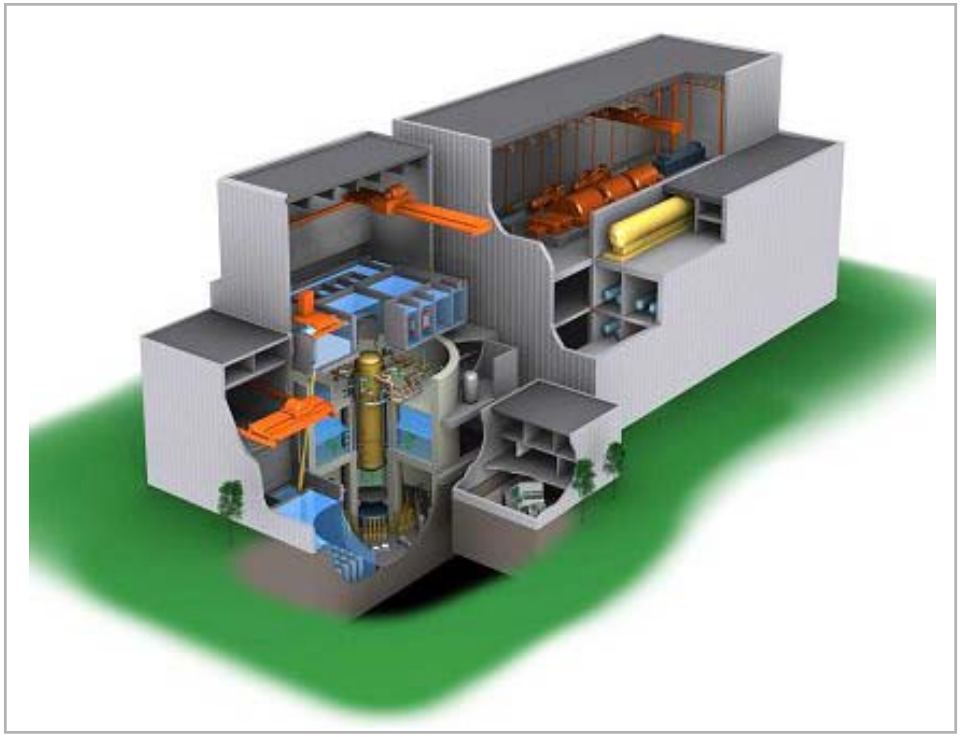
ESBWR Chapter 2: Site Characteristics



Advisory Committee on Reactor Safeguards

David A. Hamon

Erik S. Kirstein

August 17, 2010

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Introduction

- The "*SER with Open Items*" for Chapter 2 from 2008 identified the following Open Items:
  - Open Item 2.3-4 – Probable Maximum Winter Precipitation (PMWP) standard plant site design parameter
  - Open Item 2.3-8 – Exclusion Area Boundary (EAB) χ/Q value
  - Open Item 2.3-9 – Main Plant Stack release pathway
  - Open Item 2.3-10 – Computer Codes used to calculation of long-term χ/Q and D/Q site design parameter values
- New Technical Topics
  - Ambient Temperature Conditions for Control Room Habitability Area (CRHA) Heat-up Analysis

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Open Item 2.3-4

Summary from SER with Open Items:

The applicant should also provide an additional roof design 48-hour Probable Maximum Winter Precipitation (PMWP) standard plant site design parameter to account for additional weight if at least part of the 48-hour PMWP falls as frozen precipitation (e.g., snow and/or ice) and therefore remains on the roof. This is **Open Item 2.3-4**.

Response:

GEH revised the DCD Tier 1 Table 5.1-1 and DCD Tier 2 Table 2.0-1 standard plant site parameters to include a parameter for (1) maximum ground snow load for normal winter precipitation event and (2) maximum ground snow load for extreme winter precipitation event.

(cont'd)

Open Item 2.3-4

Conclusion:

Changes made are consistent with interim staff guidance provided in COL/DC-ISG-7.

DCD Tier 1 Table 5.1-1 and DCD Tier 2 Table 2.0-1 standard plant site parameter for maximum ground snow load for normal winter precipitation event bound a number of sites that may be considered within a COL application.

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Open Item 2.3-9

Summary from SER with Open Items:

One of the release pathways discussed is the main plant stack, which is not part of the ESBWR standard plant design. Because the main plant stack is not part of the ESBWR standard plant design, the DCD should explicitly state that the COL applicant should confirm at the COL stage that the main plant stack EAB and Low Population Zone (LPZ) χ/Q site characteristic values are less than or equal to the ESBWR EAB and LPZ χ/Q standard plant site design parameters. This is identified as **part of Open Item 2.3-9**.

The information requested in paragraphs 2.3.4.3.2.a through 2.3.4.3.2.i above are identified as **part of Open Item 2.3-9**.

(cont'd)

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Open Item 2.3-9

Response:

GEH removed the main plant stack and added three ventilation stacks to the ESBWR standard plant design.

In resolving follow-on supplements to RAI 2.3-9, Appendix 2A was added to Chapter 2 in DCD R5 to provide COL applicants the ARCON96 parameters (such as release and intake locations) for use in calculating their control room X/Q values.

GEH also noted that DCD COL item 2.0-1-A required a COL applicant to demonstrate that site characteristics for a given site fall within the ESBWR DCD site parameter values per 10 CFR 52.79.

(cont'd)

Open Item 2.3-9

Conclusion:

GEH added three ventilation stacks to the ESBWR standard plant design, added DCD Appendix 2A to provide control room X/Q calculation inputs for a COL applicant, and referred to COL item 2.0-1-A.

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Open Item 2.3-10

Summary from SER with Open Items:

GEH should describe (1) the input assumptions used in executing the XOQDOQ computer code to derive the ESBWR DCD long-term χ/Q site design parameter value of 2.0×10^{-6} s/m^3 and (2) the technical bases for the GE REFAE computer code and the input assumptions used in executing the GE REFAE computer code to derive the ESBWR DCD long-term D/Q site design parameter value of 4.0×10^{-9} m^{-2}. This is **Open Item 2.3-10**.

RAI 2.3-10 supplements (and RAI 12.2-28) stated that DCD long term X/Q and D/Q values may not bound a reasonable number of COL sites.

(cont'd)

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Open Item 2.3-10

Response:

GEH added Appendix 2B to the DCD to provide the release pathway information for use with the XOQDOQ computer code for each of the three ventilation stacks for use by COL applicants in generating site specific annual average χ/Q and D/Q values.

DCD, Tier 2, Table 2B-1, provides ventilation stack parameters that are specific for the ESBWR. In addition, the X/Q and D/Q values cited in Open Item 2.3-10 have been replaced in the DCD by long term dispersion and deposition factors specific to each of the three ventilation stacks.

GEH performed 10 CFR 50 Appendix I analyses for several plant sites using ESBWR stack design (and plant site meteorological data), and demonstrated that resulting dose criteria were met.

(cont'd)

Open Item 2.3-10

Conclusion:

The concern has been addressed by the addition of Appendix 2B to the DCD which provides the release pathway information for the three ventilation stacks for use with the XOQDOQ computer code.

Additionally, GEH demonstrated that ESBWR stack design would yield doses within 10 CFR 50 Appendix I criteria for several plant sites.

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CRHA Heat-up Analysis Parameters

Summary of issue:

Provide additional ambient design temperature site parameters to support CRHA heat-up analysis

Response:

GEH revised DCD Tier 2 Table 2.0-1 to include the following three additional parameters:

- Maximum Average Dry Bulb Temperature for 0% Exceedance Maximum Temperature Day: 39.7 °C (103.5 °F)
- Minimum Average Dry Bulb Temperature for 0% Exceedance Minimum Temperature Day: -32.5 °C (-26.5 °F)
- Maximum High Humidity Average Wet Bulb Globe Temperature Index for 0% Exceedance Maximum Wet Bulb Temperature Day: 30.3 °C (86.6 °F)

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Summary

- All issues from SER with Open Items have been addressed for DCD Tier 2 Chapter 2
- No Open RAIs

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United States Nuclear Regulatory Commission

Protecting People and the Environment

Presentation to the ACRS Subcommittee

ESBWR DCD Application Review

AFSER Chapter 2
Site Characteristics

August 17, 2010

Staff Review Team

- Technical Staff
  - Brad Harvey, Sr. Physical Scientist (Meteorologist)
- Project Management
  - David Misenhimer

Overview

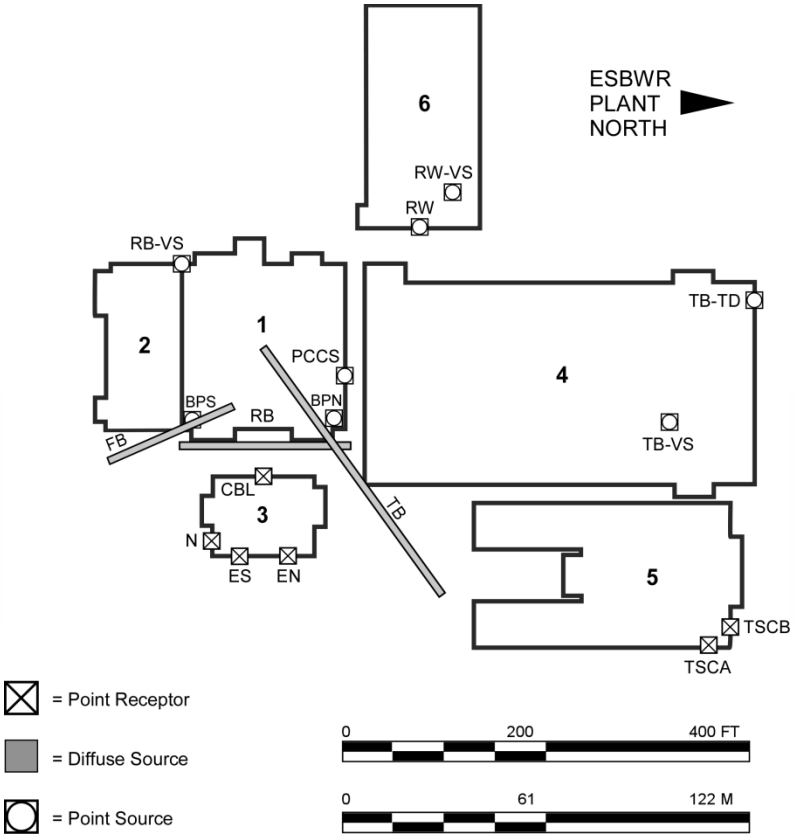
- Resolution of Significant Open Items in the SER/OI
  - Specify ground snow load site parameters for normal and extreme winter precipitation roof loads (Open Item 2.3-4)
  - Identify potential release pathways and receptor locations for the control room χ/Q values (Open Item 2.3-9)
  - Provide assumptions used in deriving the long term dispersion χ/Q and D/Q site parameters (Open Item 2.3-10)
- Technical Topics of Interest
  - 3 new ambient design temperature site parameters to support CRHA heat-up analysis
  - Wind load design criteria for Seismic Category I/II structures versus RTNSS structures

Ground Snow Load

- Initial DCD Site Parameter Values
  - Max 100-yr ground snow load: 50 lbf/ft^2
  - Max 48-hr winter rainfall: 36 inches
- ISG-7
  - Normal winter precipitation roof load
    - 100-yr (or historic) snowpack
  - Extreme winter precipitation roof load
    - 100-yr (or historic) snowpack +
    - 100-yr 2-day snowfall or 48-hr PMWP
- Revised DCD Site Parameter Values
  - Max normal ground snow load: 50 lbf/ft^2
  - Max extreme ground snow load: 162 lbf/ft^2

Control Room χ/Q Values

- Open Item 2.3-9
  - Identify control room intake and inleakage locations and potential release pathways for each accident
- Resolution
  - Appendix 2A added to DCD Tier 2



DCD Tier 2 Figure 2A-1

Potential CR Sources and Receptors

Long Term χ/Q and D/Q Values

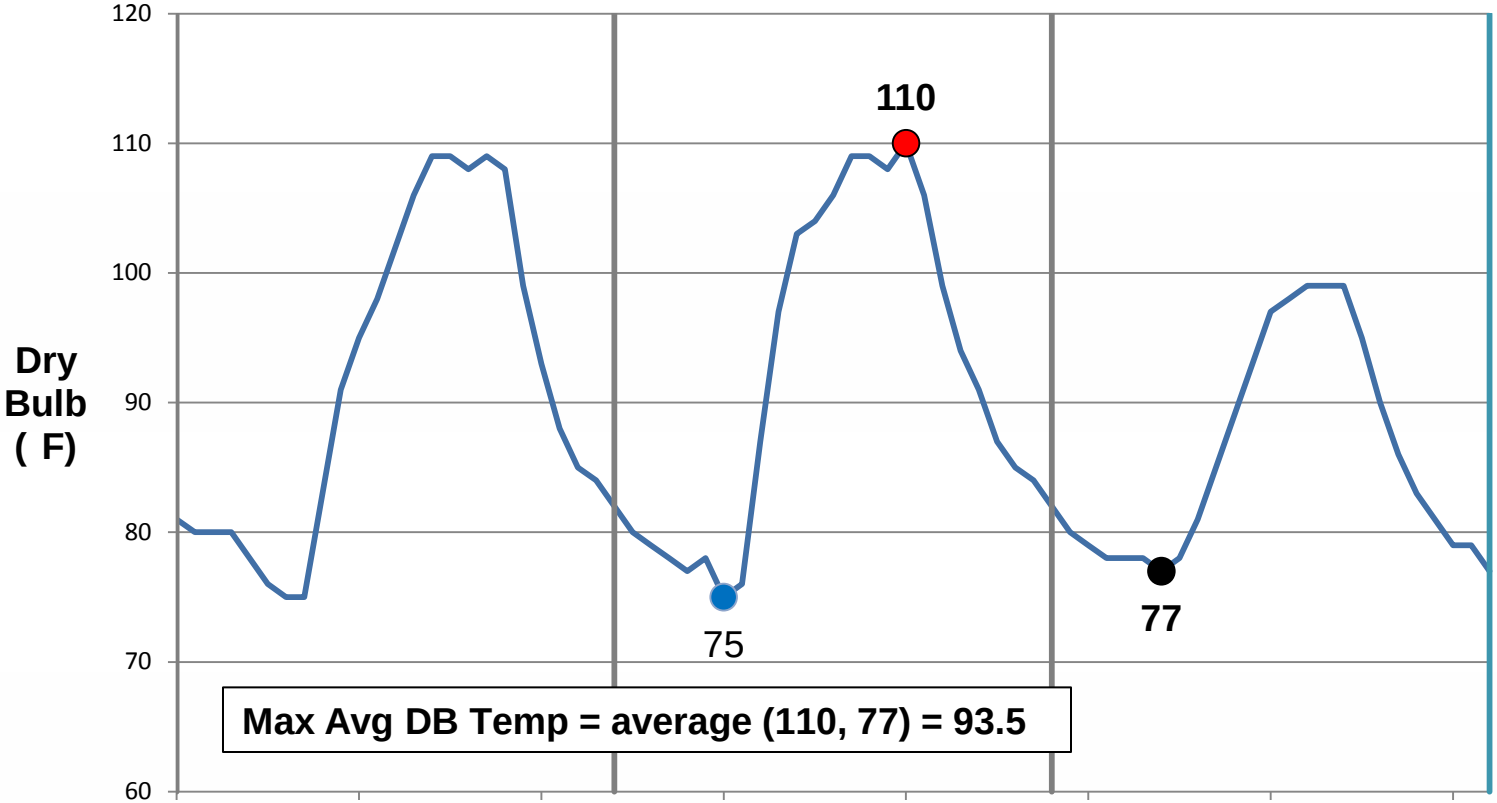
- Open Item 2.3-10
  - DCD long term χ/Q and D/Q values may not bound a reasonable number of COL sites
- Resolution
  - Applicant demonstrates ESBWR design yields acceptable gaseous effluent doses

Ambient Design Temperature Site Parameters

2% Annual Exceedance	Max	DB	96 °F
		MCWB	79 °F
		WB	81 °F
	Min	DB	-10 °F
1% Annual Exceedance	Max	DB	100 °F
		MCWB	79 °F
		WB	82 °F
	Min	DB	-10 °F
0% Exceedance	Max	DB	117 °F
		MCWB	80 °F
		WB	88 °F
	Min	DB	-40 °F
Max Avg DB for 0% Exceedance Max Temp Day			**103.5 °F**
Min Avg DB for 0% Exceedance Min Temp Day			**-26.5 °F**
Max HH Avg WBGT Index for 0% Exceedance Max WB Day			**86.6 °F**

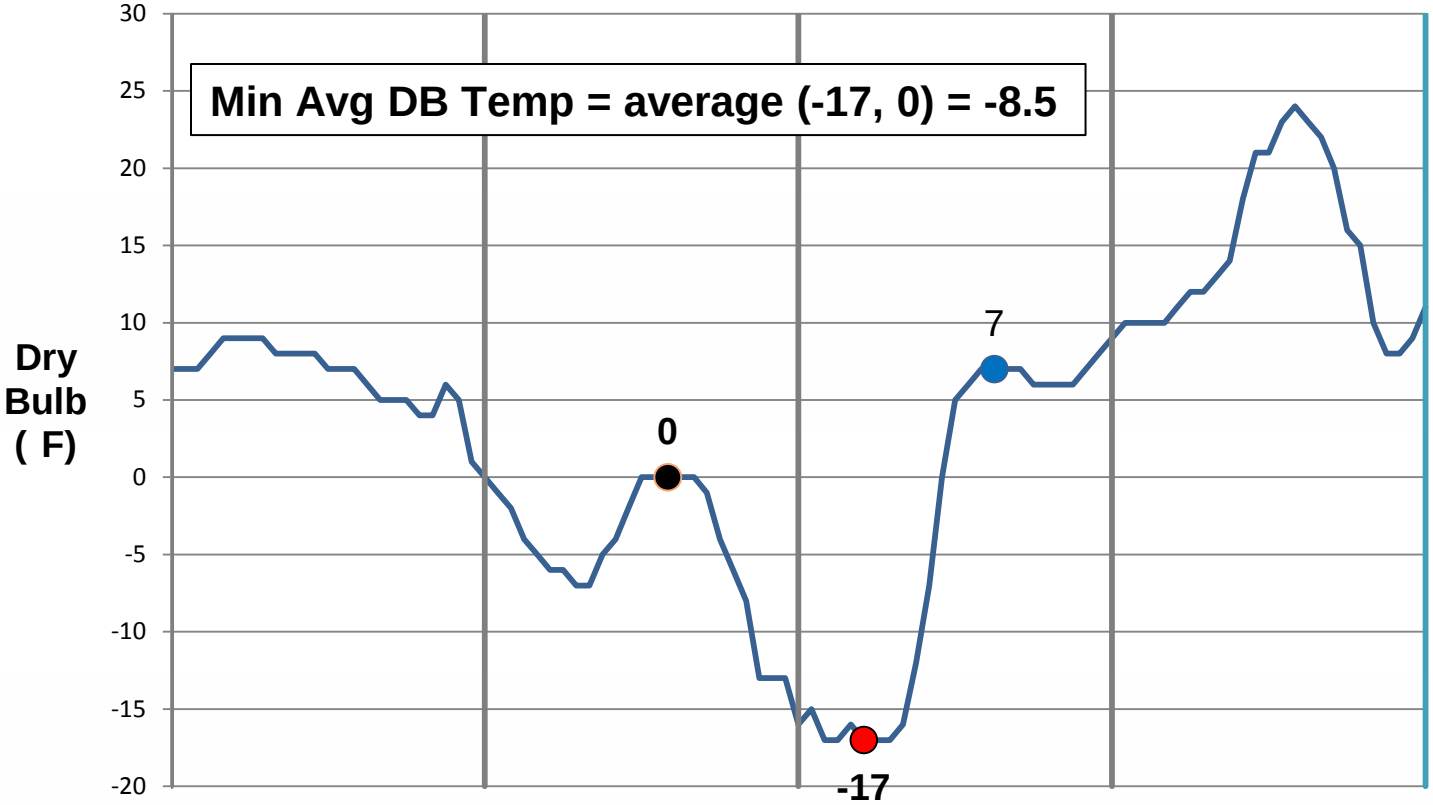
CRHA Heat-Up Site Parameter

1. Maximum Average Dry Bulb Temperature for 0% Exceedance Maximum Temperature Day: 103.5 F



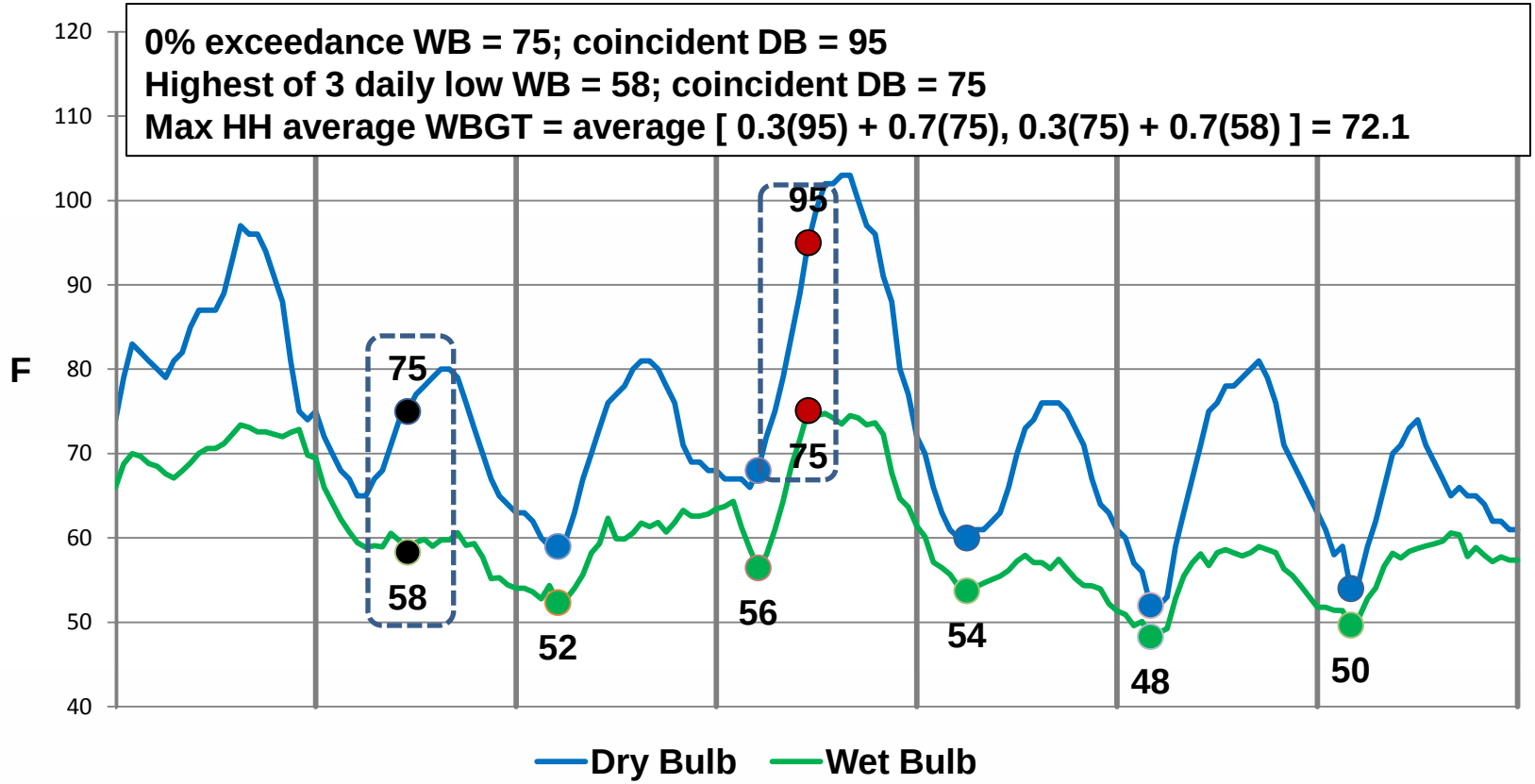
CRHA Heat-Up Site Parameter

2. Minimum Average Dry Bulb Temperature for 0% Exceedance Minimum Temperature Day: <u>-26.5 F</u>



CRHA Heat-Up Site Parameter

3. Maximum High Humidity Average WBGT Index for 0% Exceedance Maximum Wet Bulb Temperature Day: 86.6 F



CRHA Heat-Up Site Parameters

- Conclusions
  - CRHA heat-up site parameters will confirm the assumptions used in the CRHA passive cooling analysis
  - The CRHA heat-up site parameters should envelope most potential COL sites

Wind Loading Criteria

- Seismic Category I Structures
  - Extreme wind (150 mph)
  - Tornado load
    - Tornado wind (330 mph)
    - Tornado missiles
- Seismic Category II Structures
  - Extreme wind (150 mph)
  - Tornado load
    - Tornado wind (330 mph)
- RTNSS Structures
  - Hurricane load
    - Hurricane wind (195 mph)
    - Hurricane missiles

Conclusion

- The applicant has provided plant specific site parameters and the staff finds those acceptable
- The applicant has properly identified the site specific information to be provided as part of the COL application
- All issues from the SER with Open Items have been addressed

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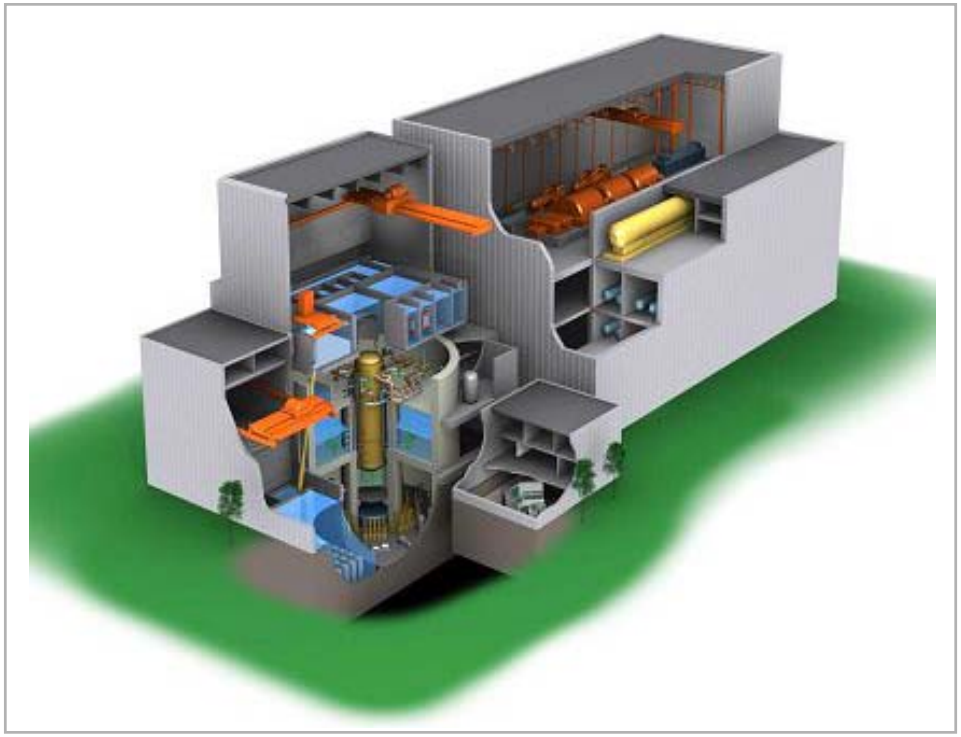
ESBWR DCD Chapter 12 Radiation Protection



Advisory Committee on Reactor Safeguards

Erik Kirstein

August 17, 2010

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Introduction

- **Open items from the 2007 SER with Open Items**
  - 28 open items identified in the SER; all resolved
  - Most significant are Open Items 12.7-1 through 12.7-3

- **Other open items of interest**
  - Open Item 12.2-9 - Inputs and assumptions supporting gaseous effluent releases in DCD Table 12.2-16
  - Open Item 12.4-31 - Post-accident radiation information in DCD Section 12.3 is incomplete

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Open Items 12.7-1 through 12.7-3

Open Item 12.7-1

- Application of NUREG/CR-35878 decommissioning facilitation techniques and features into the ESBWR

Open Item 12.7-2

- How decommissioning operations are facilitated in ESBWR design (and how radwaste generation is minimized during decommissioning)

Open Item 12.7-3

- Identify any below-grade piping or components that have a potential for leaking radioactive contaminated fluids

(cont'd)

All three Open Items tied to conformance to 10 CFR 20.1406, "Minimization of Contamination"

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Open Items 12.7-1 through 12.7-3

10 CFR 20.1406 Minimization of Contamination

(a) Applicants for licenses, other than early site permits and manufacturing licenses under part 52 of this chapter and renewals, whose applications are submitted after August 20, 1997, shall describe in the application how facility design and procedures for operation will minimize, to the extent practicable, contamination of the facility and the environment, facilitate eventual decommissioning, and minimize, to the extent practicable, the generation of radioactive waste.

(b) Applicants for standard design certifications, standard design approvals, and manufacturing licenses under part 52 of this chapter, whose applications are submitted after August 20, 1997, shall describe in the application how facility design will minimize, to the extent practicable, contamination of the facility and the environment, facilitate eventual decommissioning, and minimize, to the extent practicable, the generation of radioactive waste.

(cont'd)

Open Items 12.7-1 through 12.7-3

After October 2007 ACRS meeting, RG 4.21 was issued:

Regulatory Guide 4.21, "Minimization of Contamination and Radioactive Waste Generation: Life Cycle Planning," June 2008.

- Provides guidance in conforming to 10 CFR 20.1406
- Appendix A of RG 4.21 lists examples of measures to control contamination
- RAIs 12.7-1 through 12.7-3 were closed out and RAI 12.7-5 was issued requesting information to address RG 4.21 guidance

(cont'd)

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Open Items 12.7-1 through 12.7-3

RAI 12.7-5 Resolution:

- In DCD Revision 6, GEH relocated information in DCD 12.6 "Minimization of Contamination and Radwaste Generation" into DCD 12.3.1.5 to satisfy RAI 12.7-5
- DCD Table 12.3-18 was added in DCD R6 to provide a cross-reference between RG 4.21 design objectives and DCD sections where they are discussed
- COL Item 12.3-4-A was added in DCD R6 to address operational and post-construction objectives of RG 4.21

(cont'd)

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Open Item 12.2-9

Open Item:

The Staff could not duplicate the gaseous effluent release concentrations in DCD Table 12.2-16

Resolution:

GEH added Appendix 12B in DCD Revision 5 to provide details forming the basis for the effluent release concentrations

- Equations supporting releases
- Assumptions and inputs
- Methodology is similar to NUREG-0016

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Open Item 12.4-31

Open Item:

The post-accident radiation zone maps in DCD Section 12.3 are incomplete

- Only provided for Nuclear Island
- Only provided dose rates in vital areas and access pathways
- Provide a description of the post-accident missions (personnel actions in vital areas) and the mission doses

Resolution:

- Added DCD Tables 12.3-12 and -13 (detailed dose rates in post-accident rooms and access ways)
- Added DCD Tables 12.3-14 through -17 (listed estimated mission doses for vital area access)
- Revised Nuclear Island post-accident rad zone maps and added detailed maps for Electrical and Service Buildings
- Added DCD figures depicting personnel access and egress routes to and from vital areas

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Summary

All open Chapter 12 items have been resolved

- DCD Section 12.3.1.5 and Table 12.3-18 added to address 10 CFR 20.1406 criteria (per RG 4.21 guidance)
- DCD Appendix 12B was added to explain basis for gaseous effluent releases from the site (DCD Table 12.2-16)
- Added numerous figures and tables to DCD to provide detailed information (radiation zones, access and egress, and mission dose rates and doses) in a post-accident environment

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Protecting People and the Environment

Presentation to the ACRS Subcommittee

ESBWR Design Certification Review
Chapter 12
"Radiation Protection"

August 17, 2010

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 12

- **Project Manager**
  - David Misenhimer

- **Technical Staff Presenters**
  - Charles Hinson, DCIP/CHPB
  - George Cicotte, DCIP/CHPB

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 12

Open Item 12.7-5

- Provide a general description of how each of the objectives (design and operational) in RG 4.21 will be met
- For each of the design objectives, provide several examples of ESBWR design features that illustrate how each of these design objectives are met by the ESBWR design
- Identify the COL action item(s) associated with each of the operational objectives in RG 4.21
- Describe design features associated with those specific plant SSGs which may generate radioactive waste
- Identify any plant systems which may have buried piping carrying radioactive fluids and describe features to minimize/detect the potential for unmonitored, uncontrolled releases of radioactivity to the environment

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 12

<u>Open Item 12.7-5 (continued)</u>

- GEH added a new subsection and a 61-page table in the DCD to address RG 4.21 design objectives. These changes include:

  - a detailed listing of ESBWR design features incorporated to address each design objective

  - a reference pointer to indicate where each design feature is further described in the DCD

- To adequately evaluate GEH's response, staff conducted awareness training with selected branches to discuss 10 CFR 20.1406, ISG-06 (compliance w/20.1406), and RG 4.21 objectives

  - CHPB requested that other branches review the new DCD table for completeness/inaccuracies and assess impact of 20.1406 on their review areas

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 12

<u>Open Item 12.7-5 (continued)</u>

- GEH also created COL Information Item 12.3-4-A (COL Applicant will address the operational and post-construction objectives of RG 4.21) to address RG 4.21 operational objectives.

- In response to a supplemental RAI, GEH identified the four ESBWR SSCs that had associated buried piping and described the design features of this buried piping that would minimize the potential for unmonitored, uncontrolled releases of radioactivity to the environment.

  - Pipes are either enclosed within a guard pipe and monitored for leakage or are accessible for visual inspections via a trench or tunnel.

  - All joints are welded with no threaded and flanged connections used underground.

  - Fittings will be kept to a minimum and no in-line components incorporated into these lines.

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 12

<u>Open Item 12.7-5 (continued)</u>

- GEH has adequately described how the ESBWR design meets the design objectives of RG 4.21 and complies with 10 CFR 20.1406 by minimizing contamination of the facility and environment, facilitating decommissioning, and minimizing the generation of radioactive waste.

- This resolves RAI 12.7-5

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 12

<u>Open Item 12.4-31</u>

- Provide a complete set of post-accident radiation zone drawings reflecting the maximum post-accident dose rates for areas requiring post-accident access
- Identify all areas which require access following an accident to mitigate the consequences of an accident (defined as “vital” areas per NUREG-0737 Item II.B.2)
- Indicate access routes to and egress routes from each vital area along with corresponding mission dose rates

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 12

<u>Open Item 12.4-31 (continued)</u>

In response, GE provided

- list of all vital areas and post-accident actions required to be performed in each of these areas
- list of estimated post-accident dose rates in each vital area and in access ways to vital areas for various times after an accident (from .5 hrs to 30 days)
- detailed breakdown of mission doses to each vital area, including the dose incurred for each room traversed in route to the vital areas

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 12

<u>Open Item 12.4-31 (continued)</u>

- Staff performed detailed review of the revised post-accident radiation zone maps to evaluate the access routes and ensure that none of the mission doses exceeded the GDC dose criteria of 5 rem

- Staff concluded that GEH had adequately addressed the requirements of 10 CFR 50.34(f)(2)(vii) as they apply to plant shielding of vital areas and the criteria in NUREG 0737, Item II.B.2

- This resolves RAI 12.4-31

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 12

<u>Open Item 12.2-9</u>

Inputs and assumptions for gaseous effluent releases

- Assumptions clarified by addition of Appendix 12B, providing sufficient information to evaluate basis for calculated release concentrations in gaseous effluents
- Staff calculations determined methodology consistent with NUREG-0016
- Subsequent revisions in basis for DCD Table 12.2-16 did not raise additional issues with methodology

- This resolves RAI 12.2-9

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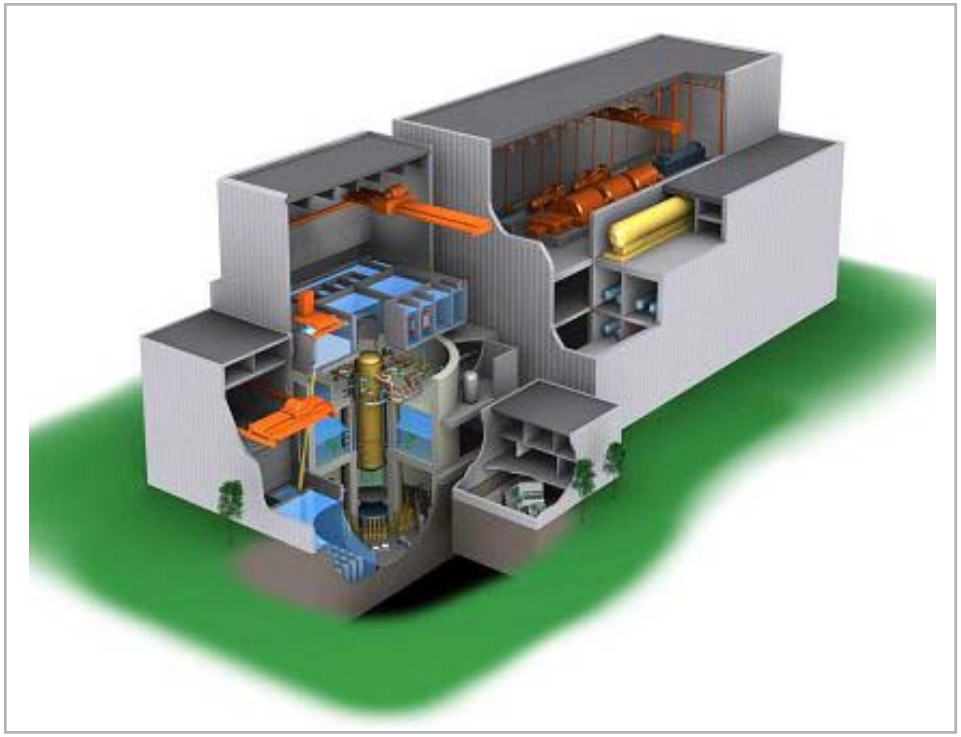
ESBWR Chapter 10: Steam Power and Conversion System



Advisory Committee on Reactor Safeguards

Gary M. Anthony

August 17, 2010

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Introduction … (Important topics to certification)

- **Approximately 106 RAIs on CH 10 or dealing with Power Conversion systems in other DCD Chapters: for example: 3, 5, 6, 14, 15, 17, 19 and Tier 1.**
- **Several telephone conferences were conducted on technical topics to provide design details information to the NRC and discuss the operation of the equipment.**
- **The bounding Missile Probability Analysis (MPA) was generated per COL information item 10.2-2-A.**
- **NRC completed a very thorough review of Safety-Related and RTNSS Category B equipment orientation and locations with respect to the potential turbine missile zone.**
- **NRC exhaustive review of turbine overspeed protection, single failure criteria, FMEA evaluations, isolation valve functions and control schema was completed.**
- **NRC review of flow Accelerated Corrosion (FAC) and materials for piping, valves, welding, In Service Inspections (ISI) was also conducted.**

The following 3 tables highlight 2007 SER with open Items:

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Open items from the 2007 SER

Open Item 10.2-18 and related subjects	**Diversity in turbine overspeed trip devices**	RAI 10.2-18 S01 & S02, DCD 10.2.2.4
	Provide overspeed basis and margin of safety between turbine primary and emergency overspeed setpoints	DCD R4, COL 10.2-1-H, 10.2.2.4, 10.2.3.4
	Turbine IST & Inspection details	RAI 10.2-20 & 22 DCD R7 10.2-1-A, 10.2.3.6
	Turbine rotor material property data	DCD R4, COL 10.2-1-H, 10.2.3.1
	Rotor fracture toughness values	DCD R5, 10.2.3.2, RAI 10.2-24
	Generate bounding Turbine Missile Probability Analysis	DCD R4, 10.2.3.4 & 10.2.3.8, COL 10.2-2-A
	Revise COL info into new 10.2.3.8 for Missile Probability Analysis	DCD R4, COL 10.2-1-H, DCD R7, 10.2-2-A
	100% UT and acceptance criteria for rotors	DCD R4, 10.2.3.5

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Open items from the 2007 SER

10.2 RAI	**Turbine Missiles protection of RTNSS "B" systems and RG 1.117 / 1.115**	RAI 10.2-18 S02
10.3.3 **Open Item 10.3-7 and Open Item 3.2-1**	**Original exclusion of "N" stamping and ANI inspection for Class 2 Main Steam piping**	RAI 10.3-7 To be resolved under Open Item 3.2-1, DCD R4, 10.3.1.1 RAI 10.3-1 & RAI 3.2-1, DCD 10.3.4
10.3.6.3.1 10.3.6.3.2 **Open Item 10.3-4**	**List MS and FW piping weld filler material specs in 10.3.6 and Class 2 FW fracture toughness**	RAI 10.3-4(a) S02, DCD 10.3.6

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Open items from the 2007 SER

10.3.6.3.1 **Open Item 10.3-4**	**Alternative to RG 1.50** (minimum welding preheat temperatures)	RAI 10.3-4 S02, DCD 10.3.6.2
10.3.6.3.3 **Open Item 10.3-6**	**Material specs and grades for non-ASME systems susceptible to erosion / corrosion**	RAI 10.3-6 S02, DCD 10.3.6 & 6.6.7
10.4.1.3	Define threshold values and operator action for chemistry excursions	DCD 10.4.6.3 & COL 10.4-1-A
10.4.2.3 & 10.4.3.3 RAI and COL Action Item 17.2.1	Add Main Condenser Evacuation System (MCES) to Table 12.3-18, COL Action Item 12.2.4.2	RAI 10.4-17, DCD Table 12.3-18 for DCD 10.4.2

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ESBWR Summary

- Favorably orientated turbine with single failure proof digital trip system and hard wired back-up manual trip.
- Mono Block Turbine and Generator Rotor Design
- Main Steam piping is code stamped ASME Code Class 2 and Seismic Class II
- Feedwater uses Chrom-Moly (P22) piping and O_2 to control FAC
- The BOP design is based upon lessons learned and operational experience with contemporary systems and materials.

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Back-up slides

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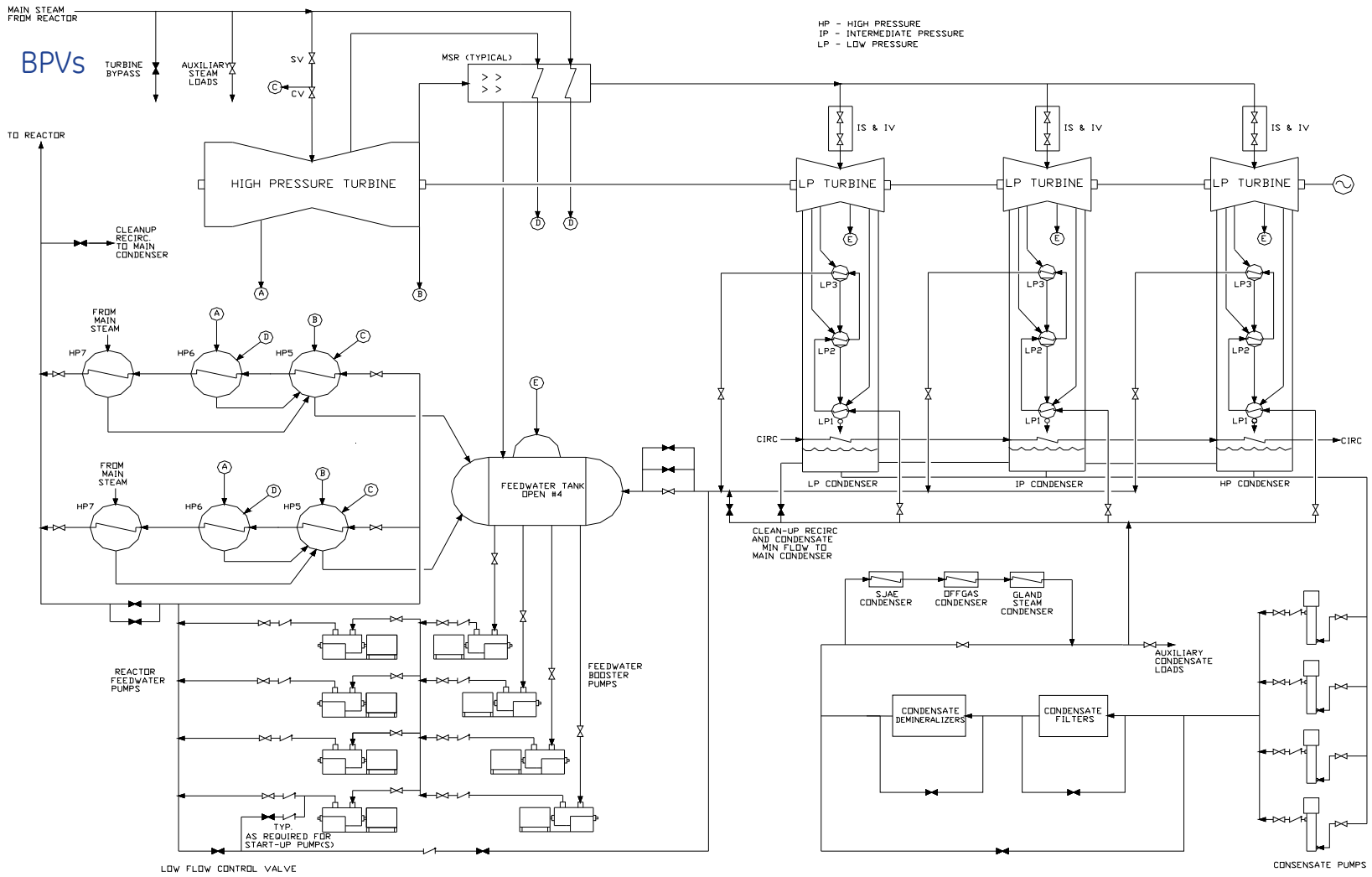
Power Cycle Schematic (DCD Figure 10.1-1),



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Materials and Welding

ASME Section III Class 2 Steam and Feedwater System Piping Materials

Component	Form	Material	Specification (ASTM/ASME)
Main Steam System			
Steam Pipe	Seamless	Carbon Steel	SA-333, Grade 6
Steam Pipe Fittings	Forgings	Carbon Steel	SA 350, Grade LF2 or SA-508, Grade 1
	Fittings	Carbon Steel	SA-420, Grade WPL-6
Feedwater System			
Pipe	Seamless	Low Alloy	SA-335, Grade P22
Fittings	Forging	Low Alloy	SA-336, Grade F22
Welding Filler Metals			
Base Metal	Filler Metal Type	SFA Number	AWS Classification
Carbon Steel P1, G1	Covered Electrodes or Filler Wire	SFA-5.1 SFA-5.18	E7018 ER70S-2 ER70S-3 ER70S-6
Carbon Steel P1, G2	Covered Electrodes or Filler Wire	SFA-5.1 SFA-5.18 SFA-5.28	E7018 ER70S-2 ER80S-D2
Low Alloy Steel P5A, G1 (2¼ CR, 1Mo)	Covered Electrodes or Filler Wire	SFA-5.5 SFA-5.1 SFA-5.28 SFA-5.18	E9016-B3 E9018-B3 E7018 ER90S-B3 ER70S-2

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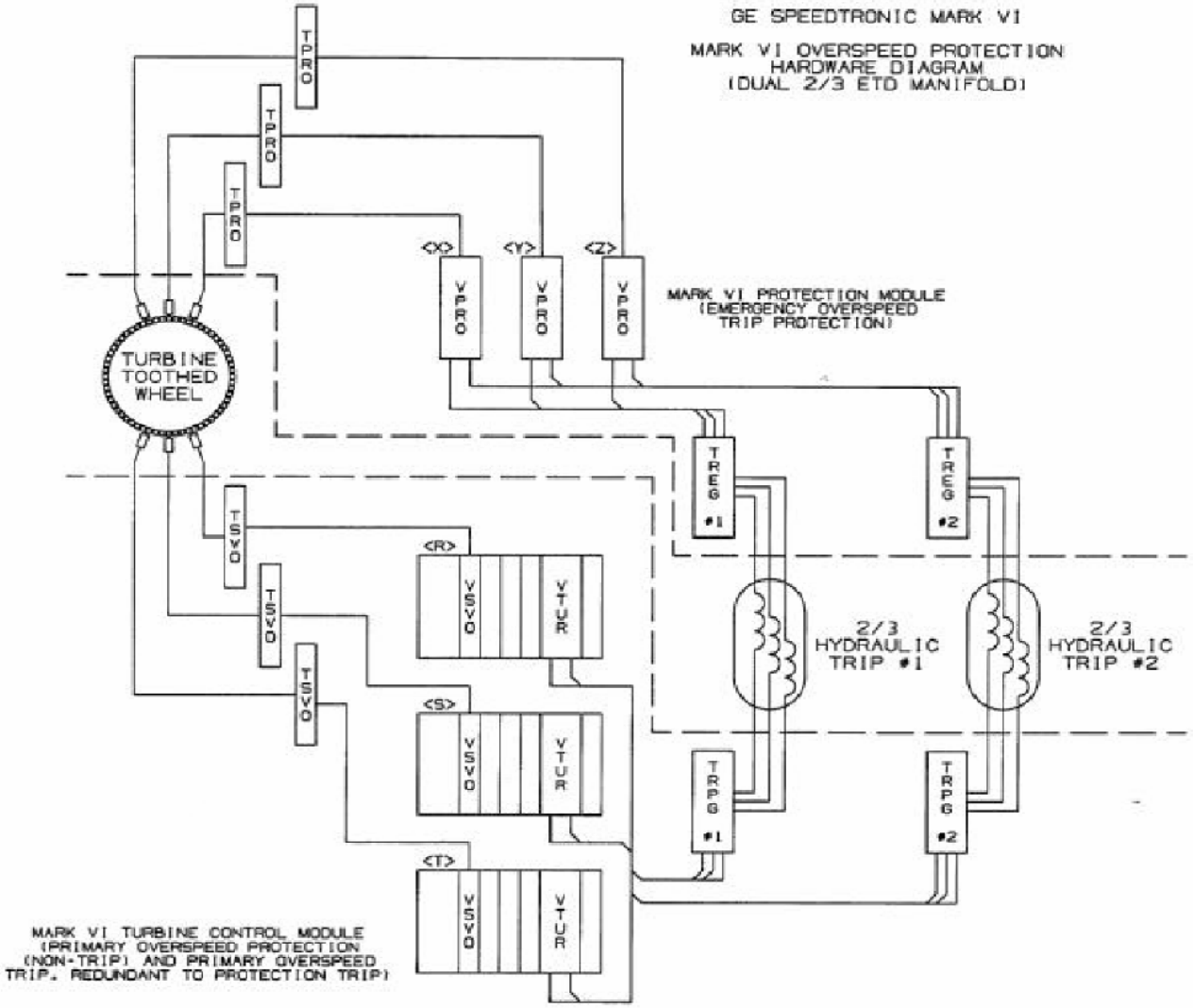
From DCD Table 5.2-4 or 10.3-2



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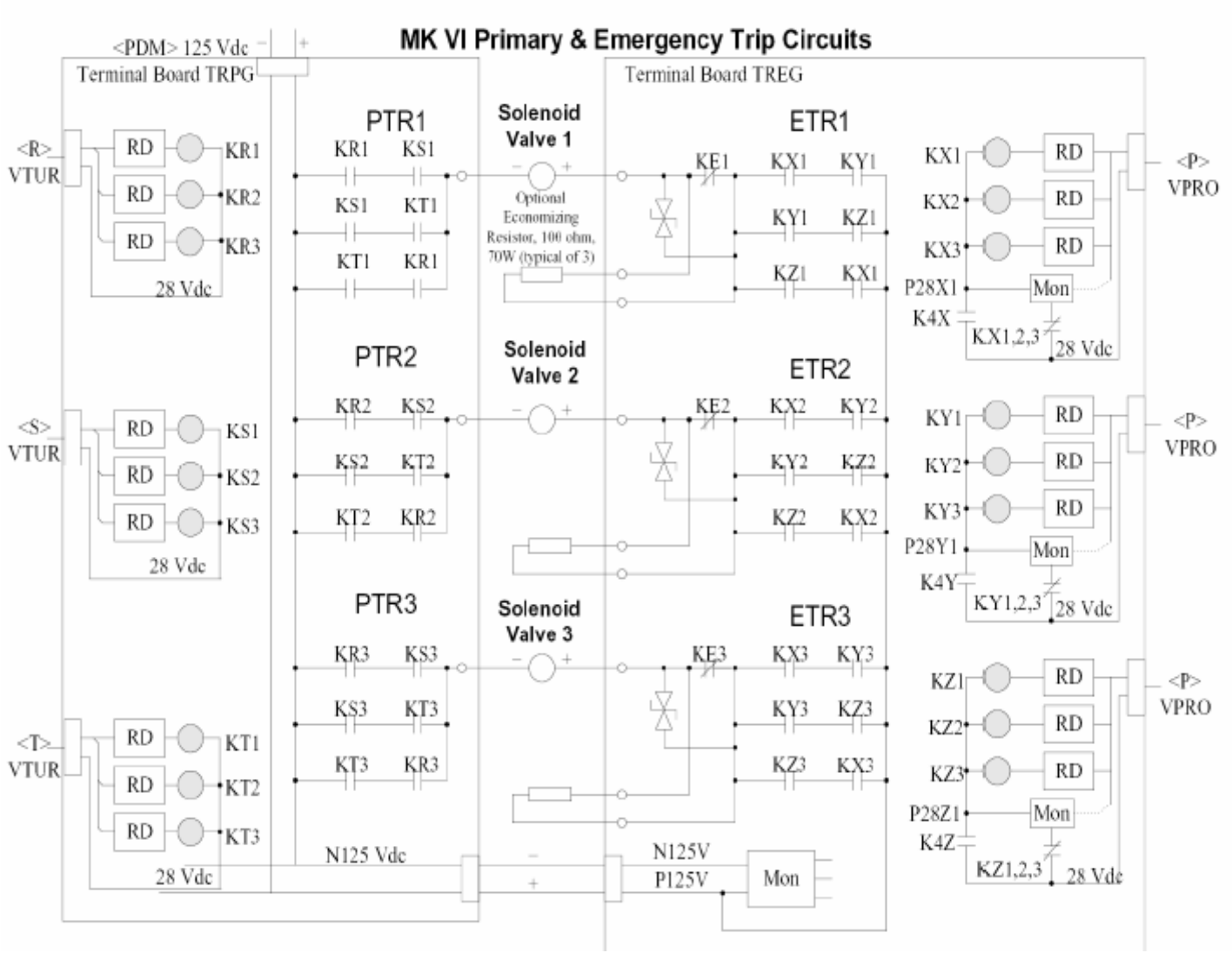
For Information Only – Actual Configuration May Differ



For Information Only – Actual Configuration May Differ

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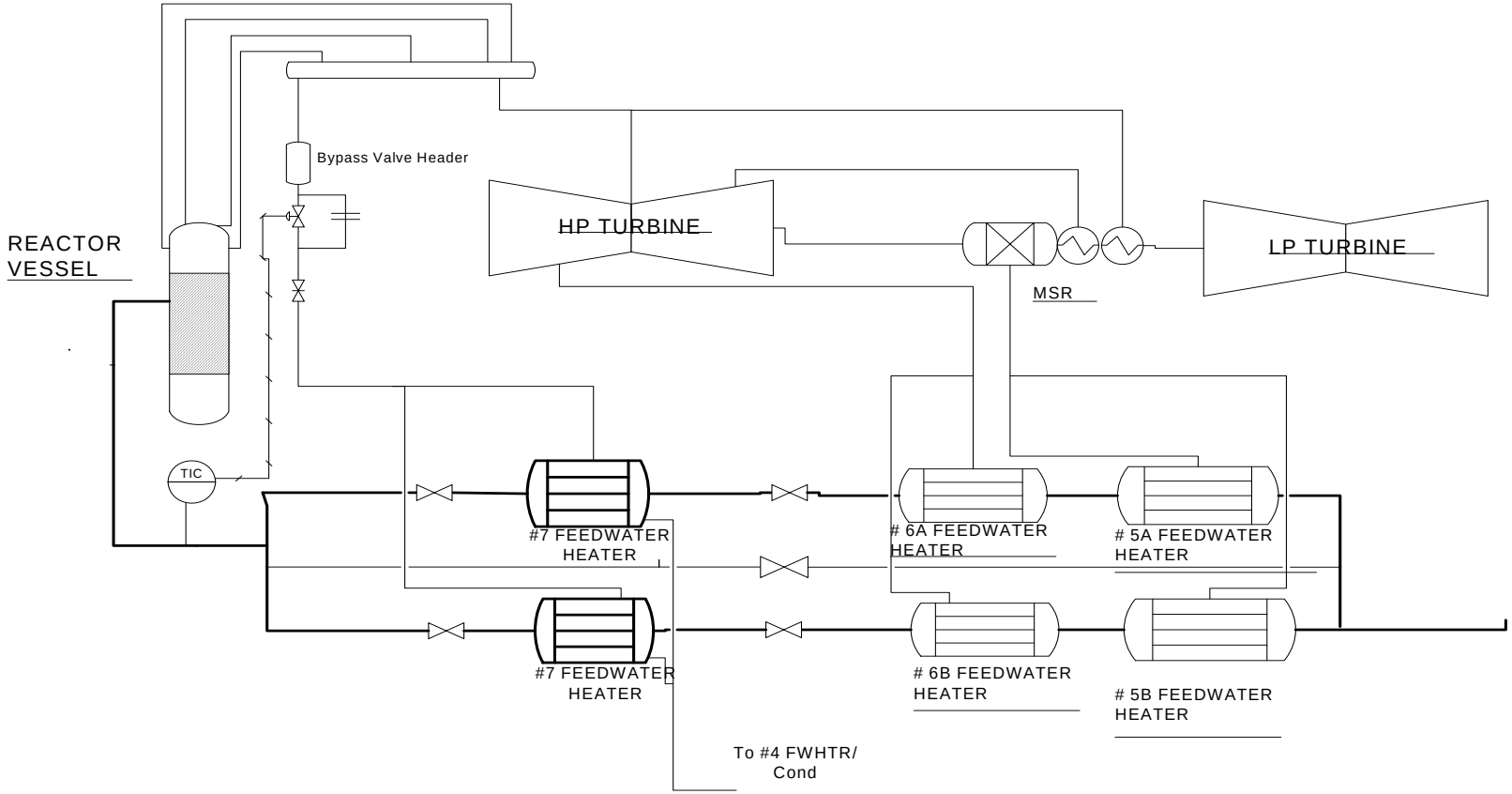
7th stage feed water heaters



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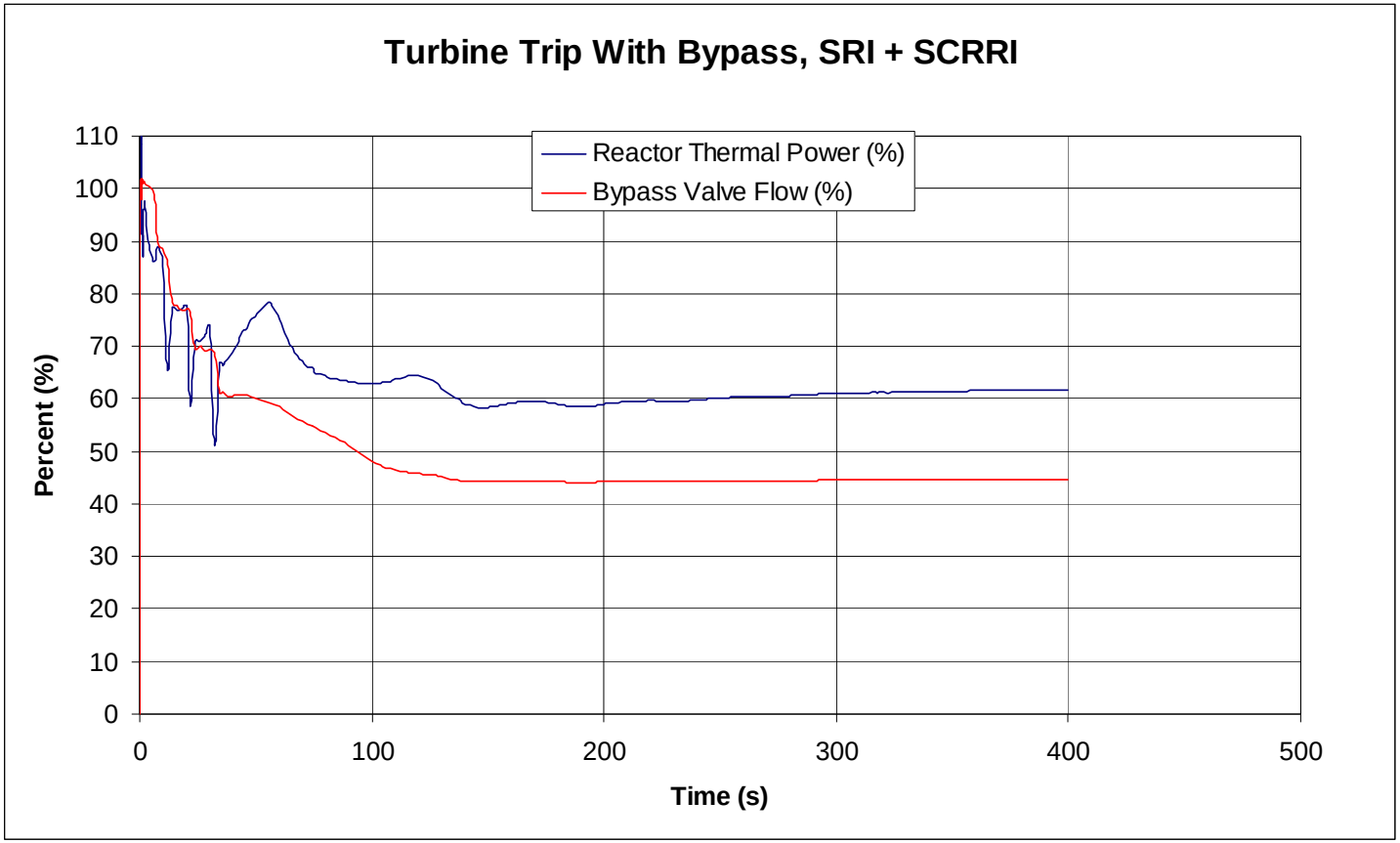
Island Mode Operation: Response with SRI + SCRRI

Values are Approximate—For Information Only



Summary: Reactor power will be quickly reduced via SRI and SCRRI to limit the energy input to the main condenser.

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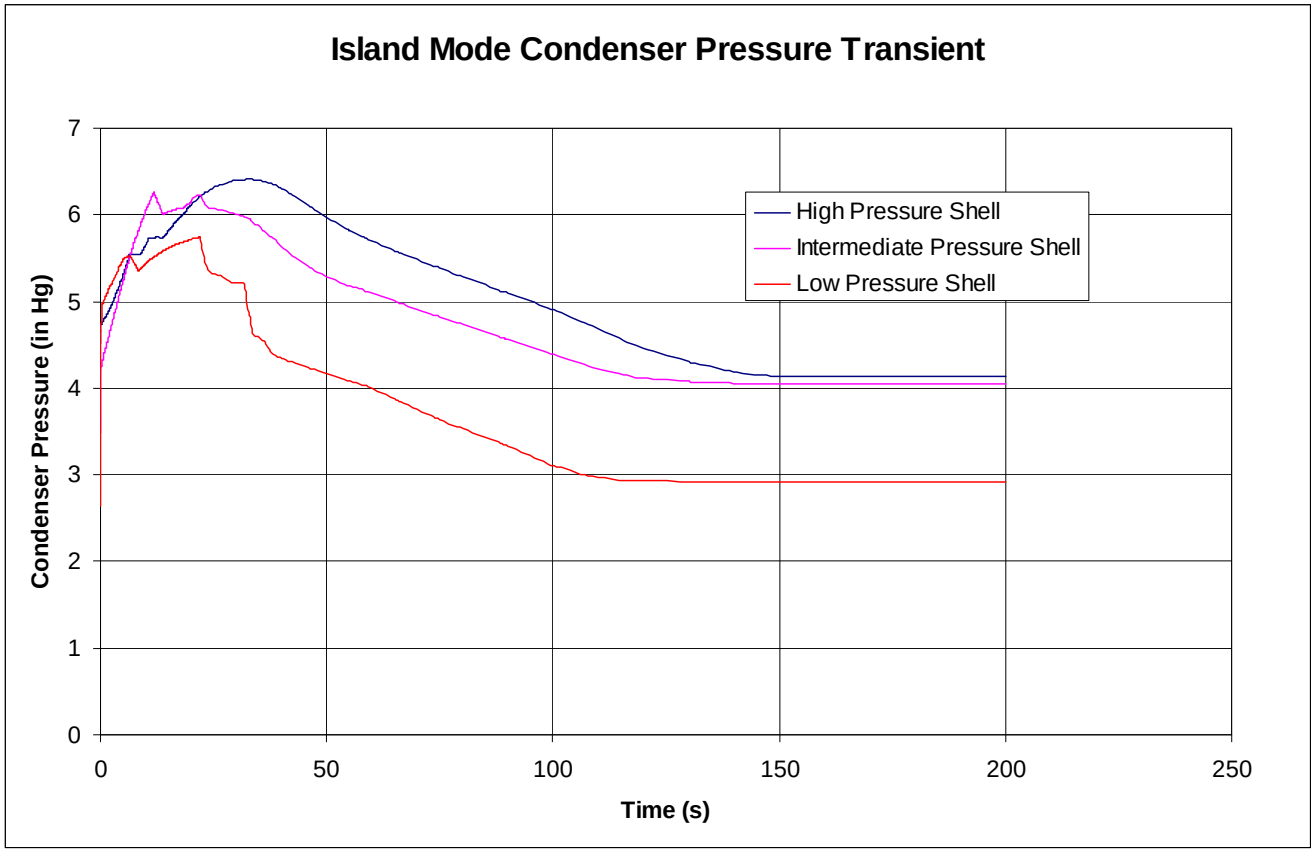
Island Mode Operation: Condenser Response

Values are Approximate—For Information Only



Summary: With SRI + SCRRI, condenser shell pressures remain below the turbine trip setpoint. The turbine operates asynchronous from the grid, powering house loads.

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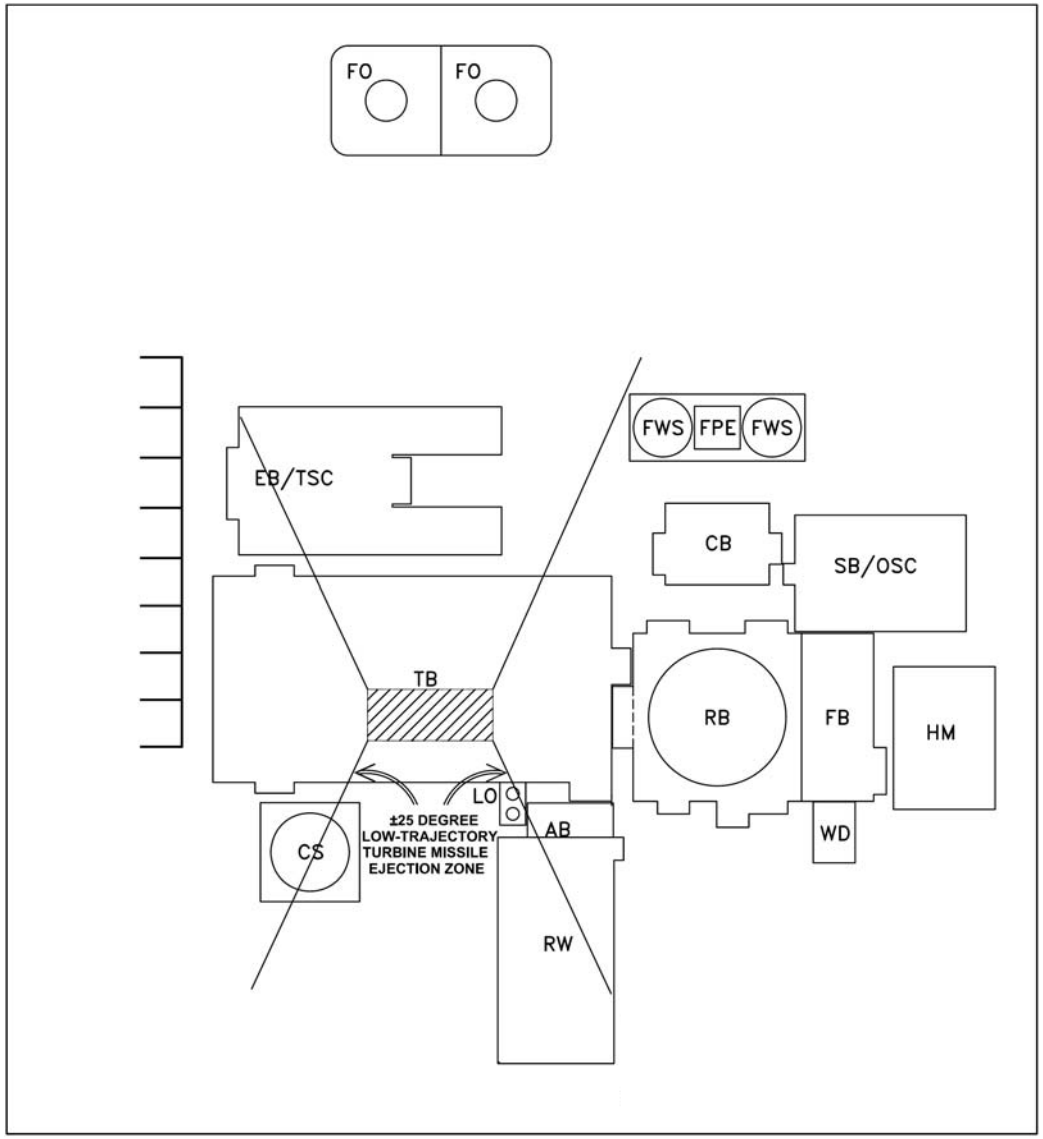
Low-Trajectory Turbine Missile Strike Zone



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Protecting People and the Environment

Presentation to the ACRS Subcommittee

ESBWR Design Certification Review
Chapter 10
"Steam and Power Conversion"

August 17, 2010

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 10

- **Project Manager**

  Leslie Perkins

- **Technical Staff Presenters**

  Devender Reddy, DSRA/SBPA/B

  Bob Davis, DE/CIB2

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 10

- SER with Open Items briefed on November 15, 2007 based on DCD Revision 3
- Discussion

  -Resolution of RAI 10.2-18, eletronic-only turbine overspeed trip system

  - Resolution of RAI 10.3-6, mitigating flow accelerated corrosion in non-ASME Code Condensate and feedwater systems

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 10

RAI 10.2-18

- Issues and NRC staff's concerns
  - Turbine overspeed and turbine missile vulnerabilities
  - Turbine overspeed control systems and its redundency, diversity, and single failure consideration
  - Staff's evaluation and RAI 10.2-18 issued
- GEH RAI response, staff's evaluation, and identification of Open Item 10-2-18
- Initial ACRS Meeting & Open Item 10.2-18 Closure

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 10

Staff's Further Review of the DC Application & Additional Concerns

- Turbine orientation and effects of low trajectory missiles on RTNSS Category-B SSCs

- Turbine speed control and overspeed protection

  -Level of diversity and redundancy concerns in primary and emergency electrical overspeed systems

  -Turbine hydraulic oil drain and air systems – redundancy concerns

  -Issuance of supplemental RAIs

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 10

Applicant's Responses & Open Item Closure

- GEH responses to RAI 10.2-18 supplements
- Staff's review of GEH responses and resolution of staff's concerns/findings:
  - The safety-related SSCs in the turbine building are fail-safe
  - No RTNSS Category-B equipment in turbine building
  - Adequate diversity and redundancy in the turbine overspeed protection systems
- Therefore, the staff finds the ESBWR T-G system design satisfactory
- No more open i66tems remained

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 10

Open Item 10.3-6

- Because the design of the non-ASME Code systems is not complete and the applicant cannot provide materials selection for the condensate and feedwater system (C&FS) , the staff requested that the applicant modify the DCD to include a COL applicant action item to include materials specifications and grades for the C&FS piping and components that could potentially be susceptible to erosion/corrosion [FAC] and discuss a basis for the selection of these materials

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 10

Open Item 10.3.6 (continued)

- In lieu of a COL Applicant Item, the applicant modified DCD Section 10.4.7 to include the following:
  - The C&FS is susceptible to FAC
  - The C&FS is designed for a 60-year life
  - Operating experience and recommendations in GL 89-08 and NUREG-1344 are applied to design and operation
  - When required by analysis, FAC resistant materials are utilized

Open Item 10.3-6 (continued)

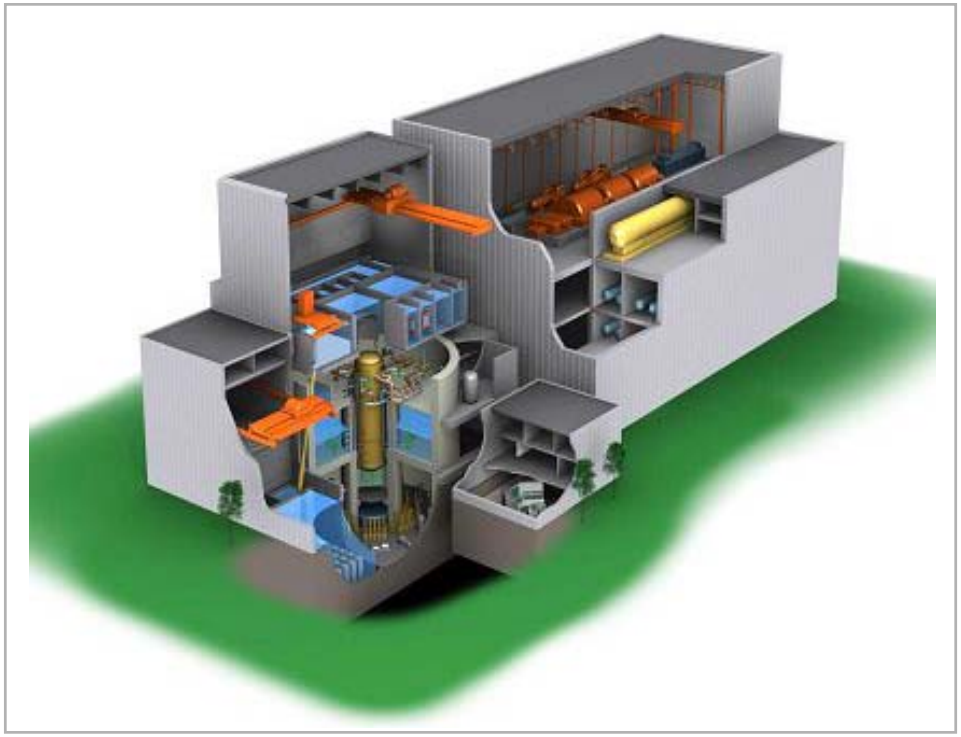
- The staff found this acceptable because the ESBWR design mitigates the effects of FAC in the non-ASME Code C&FS by selecting materials that will meet a 60-year design life taking into account the effects of FAC

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 10

Discussion/Committee Questions

GE Hitachi Nuclear Energy

ESBWR Chapter 14 "Verification Programs"



Advisory Committee on Reactor Safeguards

Patricia Campbell

Wayne Marquino

August 17, 2010

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Introduction

- Chapter 14, "Verification Programs," addresses initial plant test programs (pre-operational and startup testing) and inspections, tests, analyses, and acceptance criteria (ITAAC)
- Presented information on Chapter 14 SER with Open Items 10/21-22/2008
  - Previous SER with Open Items for Section 14.2 included 5 open items
  - Previous SER with Open Items for Section 14.3 included ~78 open items
- Open items were resolved in Revision 6 or Revision 7, or have been resolved through RAI responses with Revision 8 changed pages that have been submitted to NRC
- We will provide a short introduction and cover three examples from the various open items in the previous SER with Open Items – one in subsection 14.2 and two in subsection 14.3.

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Introduction

Objectives of the Initial Test Program are to:

- Ensure that the construction is complete and acceptable;
- Demonstrate the capability of structures, systems, and components to meet performance requirements;
- Effect fuel loading in a safe manner;
- Demonstrate, where practical, that the plant is capable of withstanding anticipated transients and postulated accidents;
- Evaluate and demonstrate, to the extent practical, plant operating procedures to provide assurance that the operating group is knowledgeable about the plant and procedures and fully prepared to operate the facility in a safe manner; and
- Bring the plant to rated capacity and sustained power operation.

Introduction

Verification Programs:

- Section 14.3 describes the selection criteria and processes used to develop the Tier 1 information and inspections, tests, analyses and acceptance criteria (ITAAC).
- Tier 1 information provides the principal design bases and design characteristics that are to be certified by the 10 CFR Part 52 rulemaking process and incorporated by reference in the formal ESBWR design certification rule.

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Open Item 14.2-97

Summary from SER with Open Items:

In RAI 14.2-97, the staff expressed concerns that the discussions of the test description and acceptance criteria for the reactor internals vibration test program (Initial Startup Flow Induced Vibration Testing) in ESBWR Rev 5, Section 14.2.8.2.11, are too broad and general. The staff also indicated that there is no reference to the GEH LTR NEDE-33259P, Revision 1, "Reactor Internals Flow Induced Vibration Program," which contains an item-by-item discussion of the components requiring testing during the startup test program of the first ESBWR, as well as the types and locations of the sensors for monitoring flow-induced vibration (FIV) behavior. The applicant should revise the test description in ESBWR Section 14.2.8.2.11 to include a discussion demonstrating conformance with this topic and other applicable references in the ESBWR DCD. The applicant's current approach to steam dryer load definition is identified as the plant-based load evaluation method, which is discussed in LTR NEDC-33408P, "ESBWR Steam Dryer-Plant Based Load Evaluation Methodology." The development of the FIV loads, as described in this report, is in accordance with RG 1.20, Revision 3. The FIV loads will be used in combination with other design loads in qualifying the steam dryer as described in LTR NEDE-33313P, " ESBWR Steam Dryer Structural Evaluation." The staff requested that the DC applicant discuss conformance with these licensing topical reports in Section 14.2.8.2.11 of the DCD. **RAI 14.2-97 is being tracked as an open item.**

Response:

GEH revised section 14.2.8.2.11 to state "A complete description of the reactor internals vibration test program is provided in 3.9.2.4." Section 3.9.2.4 was revised to contain a summary of the test program and now states "Details of the initial startup vibration test program are described in Subsection 3L.4.6 for the steam dryer and Section 3L.5 for other reactor internals. A brief summary is given below."

Conclusion:

The vibration test program for reactor internals is described in detail in a GEH Topical Report.

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Open Item 14.3-174, S01

Summary from SER with Open Items:

In this RAI supplement, the staff asked the applicant to provide additional details and clarifications regarding airborne radioactivity monitoring. Specifically, the staff requested the applicant to clearly identify the airborne radioactivity monitors that meet the sensitivity and location criteria to ensure that plant personnel are not inadvertently exposed to airborne contaminants in excess of the limits provided in 10 CFR Part 20. The staff requested that the applicant include a listing of these monitors in ITAAC. In addition, the staff requested that the applicant provide a table in the appropriate part of the DCD specifying which of the airborne radioactivity monitors meet the sensitivity and location criteria. The staff also asked the applicant to provide AC for the location of these airborne radioactivity monitors. **This RAI supplement is being tracked as an open item.**

Response:

In GEH's revised response to this supplemental RAI, GEH committed to revise DCD, Tier 2, Section 12.3.4, in Revision 8, to state that portable airborne radiation monitors will be used to provide the local airborne radioactivity monitoring to meet requirements for worker protection.

Conclusion:

The final changes associated with this RAI are consistent with NRC endorsed industry guidance for portable airborne monitors. It ensures that the portable continuous air monitors will be placed in the appropriate locations for alerting personnel to sudden changes in airborne contamination, and is implemented through a COL action item.

Open Item 14.3-413

Summary from SER with Open Items:

In response to RAI 8.2-14 regarding the effects of voltage spike on the electrical distribution system components after loss of the electrical grid during islanding, GEH stated that fast transients on the alternating current input to the UPS input rectifiers and battery chargers can result in high direct current voltages and, if the rectifiers and inverter trips are not coordinated, subsequent inverter trips and loss of power to safety-related loads can occur. Since trip coordination of battery chargers and UPS input rectifiers with inverters is critical for proper operation of UPS under excessive alternating current input voltage conditions during islanding mode, an ITAAC is necessary to verify the trip coordination of safety-related battery chargers and UPS input rectifiers with inverters. As a result of staff review of this RAI response, the staff requested that the applicant provide an ITAAC to address proper operation of the above devices. **This RAI is being tracked as an open item.**

Response:

GEH revised DCD, Tier 1, Subsection 2.13.5 and Table 2.13.5-2 to include the requirement to verify trip coordination of the safety-related battery chargers and UPS input rectifiers with the inverters. This new DCD Tier 1, ITAAC is based on new information to be added to DCD, Tier 2, Subsection 8.3.1.1.3 which discusses coordination of the rectifier and inverter high direct current voltage trips.

Conclusion:

The new ITAAC ensures thorough testing trip coordination of the UPS inverter high DC input voltage trip setpoint and time delay to be greater than the associated battery charger and UPS rectifier high DC output voltage trip setpoint and time delay. This addresses voltage spikes that might occur after loss of the electrical grid during the islanding mode of operation.

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Summary for Chapter 14

- GEH has adequately addressed all SER with Open Item issues in Chapter 14
  - Associated changes were made to Tier 1 when ITAAC were changed or added

The Initial Test Program and Verification Program through ITAAC Process will provide reasonable assurance that a future plant is ready to operate.

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Backup Slides

Chapter 14

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Subsection 14.2 Previous Open Items

RAI Number	Open Action Description	Resolution
RAI 14.3-70 S01	Include testing of channel response time or sensor calibration and testing for SSLC system channels and sensors in SSLC preoperational test description.	Material was added to DCD, Section 14.2.8.1.6, to explain purpose of testing and refers to functional testing performed during Factory Acceptance Testing or Site Acceptance Testing.
RAI 14.2-73 S01	Describe major functions for leak detection and isolation system preoperational testing, including LD&IS controls, interlocks, and bypasses that are verified through ITAAC.	Material was added to DCD, Section 14.2.8.1.8, to explain purpose of testing and refers to functional testing performed during Factory Acceptance Testing or Site Acceptance Testing.
RAI 14.2-98	Include additional items in initial test program or provide justification for exclusion: (a) verification of voltage against actual measurements, and (b) verification of proper operation of automatic transfer switch.	Added item (a) to subsection 14.2.8.1.36 and described how item (b) is already included in subsection 14.2.8.1.36 through verification of proper operation of initiating, transfer and trip devices.

Subsection 14.2 Previous Open Items

RAI Number	Open Action Description	Resolution
RAI 14.2-24 S01	Describe implementation of program to address potential adverse flow effects from vibration caused by hydrodynamic loads and acoustic resonance on safety-related piping and components in reactor coolant, steam and feedwater system, and reactor internals (e.g., steam dryer).	Explained how vibration is addressed in testing for these systems and components and referred to responses to RAI associated with steam dryers (RAIs 3.9-70 and 3.9-68). DCD was not changed.
RAI 14.2-97	Discuss with more specificity how testing addresses reactor internals vibration.	Added to subsection 14.2.8.2.11 a reference to subsection 3.9.2.4 for a complete description of reactor internals vibration test program.

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Subsection 14.3 Previous Open Items

14.3-43 S01	14.3-220 S01	14.3-350	14.3-396	14.3-410	14.3-424
14.3-61 S02	14.3-221 S01	14.3-351 S01	14.3-397	14.3-411	14.3-425
14.3-131 S03	14.3-225	14.3-352 S03	14.3-398	14.3-412	14.3-426
14.3-174 S01	14.3-229 S01	14.3-353 S01	14.3-399	14.3-413	14.3-427
14.3-175 S01	14.3-250 S01	14.3-354 S01	14.3-400	14.3-414	14.3-428
14.3-196 S01	14.3-259 S01	14.3-368 S01	14.3-401	14.3-415	14.3-429
14.3-204 S02	14.3-261	14.3-374 S01	14.3-402	14.3-416	14.3-430
14.3-211	14.3-262 S01	14.3-379 S01	14.3-403	14.3-417	14.3-431
14.3-212	14.3-263	14.3-384 S01	14.3-404	14.3-418	14.3-432
14.3-213 S02	14.3-265 S01	14.3-387	14.3-405	14.3-419	14.3-433
14.3-216 S01	14.3-271	14.3-394 S01	14.3-406	14.3-420	14.3-434
14.3-217 S02	14.3-301 S01	14.3-395	14.3-407	14.3-421	14.3-435
14.3-218	14.3-345 S01		14.3-408	14.3-422	
			14.3-409	14.3-423	

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Protecting People and the Environment

Presentation to the ACRS Subcommittee

ESBWR Design Certification Review
Chapter 14
"Verification Programs"

August 17, 2010

ACRS Subcommittee Presentation
ESBWR Design Certification Review
Chapter 14

- **Project Manager**
  - Leslie Perkins

- **Technical Staff Presenters**
  - Frank Talbot, DCIP/CQVB
  - Amar Pal, DE/EEB
  - Charlie Hinson, DCIP/CHPB

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- SER with Open Items briefed on October 21, 2008 based on DCD Revision 5
- Discussion
  - Resolution of RAI 14.2-97
    - Flow induced vibration tests
  - Resolution RAI 14.3-413
    - ITAAC to verify trip coordination
  - Resolution of RAI1 4.3-174 S01
    - ITAAC for airborne monitors

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Resolution of RAI 14.2-97

- In RAI 14.2-97, the NRC staff expressed concerns in ESBWR Subsection 14.2.12.2.11, Rev 5, that the flow induced vibration (FIV) test descriptions and acceptance criteria for the reactor internals were too broad and general. Specifically, the staff considered the following GEH licensing topical reports to contain details on the FIV program:

  -GEH NEDE-33259P, Reactor Internals Flow Induced Vibration Program.
  -GEH NEDC-33408P, ESBWR Steam Dryer-Plant Based Load Evaluation Methodology.
  -GEH NEDE-33313P, ESBWR Steam Dryer Structural Evaluation

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Resolution of RAI 14.2-97 (continued)

- In Rev 6, to DCD Subsection 14.2.8.2.11, GEH added a cross reference to DCD Subsection 3.9.2.4 which contains details on the ESBWR FIV program. DCD Subsection 3.9.2.4 was further revised to reference the GEH topical reports noted in the previous slide. Based on these revisions, the staff concluded that the FIV test descriptions and acceptance criteria were adequate.
- This resolved RAI 14.2-97.

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Resolution of RAI 14.3-413

- The staff requested GEH to add an ITAAC to verify trip coordination of safety related battery chargers and UPS input rectifiers with inverters.

- GEH provided an ITAAC to verify trip coordination and RAI 14.3-413 is resolved.

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<u>Resolution of 14.3-174 S01</u>

- Staff requested that GEH provide an ITAAC for those airborne radioactivity monitors which are used to monitor airborne radioactivity levels for normally occupied areas of the plant in which there exists a significant potential for airborne contamination.

- GEH added ITAAC for airborne radioactivity monitoring to DCD Tier 1 Section 3.4
  - addressed monitor sensitivity and location criteria
  - did not specify which monitors ITAAC applied to

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Resolution of 14.3-174 S01 (continued)

- In response to staff request to identify which monitors ITAAC applied to, GEH modified response to state that portable CAMs, instead of fixed, in-plant monitors, would be used to meet requirements for worker protection. These CAMs

  - will be used in occupied areas to alert personnel to sudden changes in airborne radioactivity concentrations

  - will have alarm setpoints set at a fraction of the concentration values of 10 CFR 20, App B, Table 1 for radionuclides which may be encountered

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Resolution RAI 14.3-174 S01 (continued)

- GEH stated that airborne radiation monitoring operational considerations are the COL Applicant's responsibility (per COL information item 12.3-2-A)
- Generic template NEI 07-03A is referenced as resolution to COL 12.3-2-A. This template states:

  - CAMs provide a means to observe trends in airborne radioactivity concentrations

  - CAMs used to alert personnel to sudden changes in airborne radioactivity concentrations

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Resolution of RAI 14.3-174 S04 (Continued)

- Since only portable radiation monitoring instrumentation will be used to conduct airborne sampling and monitoring, and ITAAC don't apply to portable equipment, GEH deleted ITAAC for airborne radioactivity monitoring from the DCD Tier 1

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- Staff finds GEH's response acceptable because the portable CAMs used to meet the requirements for worker protection in the local areas will meet the sensitivity and location criteria specified in the SRP to ensure that plant personnel are not inadvertently exposed to airborne contaminants in excess of the limits provided in 10 CFR Part 20

- RAI 14.3-174 is resolved (tracked as confirmatory item)

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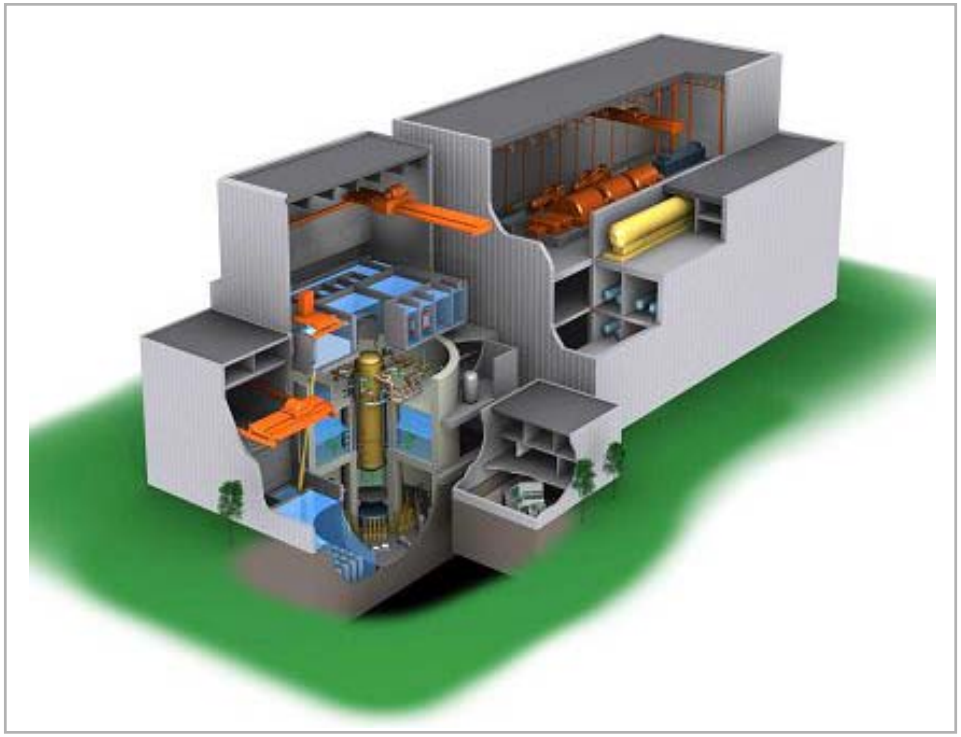
Discussion/Committee Questions

GE Hitachi Nuclear Energy

Chapter 16: Technical Specifications



Advisory Committee on Reactor Safeguards

Sara R. Andersen

August 17, 2010

HITACHI

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Introduction

All RAIs have been addressed and responses have been reviewed by staff.

All previous open items have been closed.

<u>Presentation Topics</u>

- Item of Interest from 2007 SER With Open Items:
  - RAI 16.0-1 – Completeness of ESBWR GTS
- Other topic of interest:
  - Passive Safety System Tech Specs

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RAI 16.0-1: Completeness of ESBWR GTS

Summary from SER with Open Items:

Explain how GEH chose the LCOs for the ESBWR GTS and ensured that the GTS satisfied the requirements of 10 CFR 50.36.

Response:

GEH performed a systematic and comprehensive evaluation of Revision 1 of the ESBWR DCD to determine the ESBWR process variables, design features, operating restrictions, and structures, systems, and components that meet one or more of the four criteria in 10 CFR 50.36(c)(2)(ii). For subsequent DCD revisions, GEH continuously assessed and maintained the GTS consistent with design changes and responses to RAIs on other DCD chapters.

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Passive Safety System Tech Specs

Development Philosophy

- Specifications developed based on BWR/6 Standard Technical Specifications (NUREG-1434, Rev 3.1)
- ESBWR Specifications for the passive safety systems are based on those STS systems with similar design functions
- Completion Times and Surveillance Frequencies:
  - Generally consistent with NUREG-1434
  - Utilize established precedents

(cont'd)

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Passive Safety System Tech Specs

ADS – Operating, LCO 3.5.1

Required Actions and Completion Times

One required ADS valve inoperable => 14 days to restore

Surveillances

- Verify adequate N2 supply pressure to SRVs => every 31 days
- Verify initiator continuity => every 31 days
- Verify actuation on actual or simulated initiation signal => every 24 months

(cont'd)

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Passive Safety System Tech Specs

GDCS – Operating, LCO 3.5.2

Required Actions and Completion Times

One required injection branch line or equalizing train inoperable => 14 days to restore

Surveillances

- Verify adequate GDCS pool level => every 12 hours
- Verify initiator continuity => every 31 days
- Verify actuation on actual or simulated initiation signal => every 24 months
- Verify flow paths not obstructed => every 10 years

(cont'd)

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Passive Safety System Tech Specs

ICS – Operating, LCO 3.5.4

Required Actions and Completion Times

One required ICS train inoperable => 14 days to restore

Surveillances

- Verify valves in correct position => every 31 days
- Verify adequate N2 supply pressure => every 31 days
- Verify initiator continuity => every 31 days
- Verify subcompartment manual isolation valves locked open => every 24 months
- Verify actuation on actual or simulated initiation signal => every 24 months
- Verify each ICS train capable of removing required heat load => every 24 months on a staggered test basis

(cont'd)

Passive Safety System Tech Specs

PCCS – LCO 3.6.1.7

Required Actions and Completion Times

One or more required PCCS condensers inoperable => 8 hours to restore

Surveillances

- Verify spectacle flanges in free flow position => Prior to entering Mode 2 or 4 from Mode 5 if containment was de-inerted in Mode 5, if not performed within the previous 92 days
- Verify each PCCS subcompartment manual isolation valve locked open => every 24 months
- Verify that both modules in each PCCS condenser have an unobstructed path from the drywell inlet through the condenser tubes to the following: (a) the GDCS pool through the drain line, and (b) the suppression pool through the vent line => every 24 months on a staggered test basis for each PCCS condenser
- Visual examination of vent catalyst module => every 24 months on staggered test basis
- Verify performance of a representative sample of vent catalyst module plates => every 24 months on a staggered test basis

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Summary

- ESBWR Tech Specs have been developed to meet the requirements of 10 CFR 50.36(c)(2)(ii)
- ESBWR Tech Specs are based on BWR/6, NUREG-1434 Standard Tech Specs
- Where design differences exist, ESBWR Tech Specs are modeled after the STS systems with similar design functions

ESBWR Tech Specs meet Regulatory Requirements

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"Technical Specifications"

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- Review based on DCD Revision 7 and applicant’s RAI responses
- Purpose
  - Brief the Subcommittee on the staff’s review of Chapter 16 of the ESBWR DC application
  - Describe resolution of significant open issues presented in 2007 briefing
  - Answer the Subcommittee's questions

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Project and Technical Review Team

- **Lead Project Manager** (PM)
  - Leslie Perkins Project Manager
- **Lead Technical Specifications Branch Reviewer**
  - Craig Harbuck Sr. Reactor Engineer
- **Lead Technical Reviewers**
  - Sang Rhow Electrical Engineer
  - Amar Pal Sr. Electrical Engineer
  - Andrzej Drozd Sr. Reactor Engineer
  - Hanry Wagage Sr. Reactor Engineer
  - George Thomas Sr. Reactor Systems Engineer
  - Raul Hernandez Reactor Systems Engineer
  - Marie Pohida Sr. Reliability & Risk Engineer
  - Edwin Forrest Reactor Systems Engineer
  - James O'Driscoll Reactor Systems Engineer

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Outline of Presentation

- Generic TS Review Criteria
- Open Issue Resolution
- Conclusion
- Discussion / Subcommittee questions

Generic TS (GTS) Review Criteria

- Meet requirements of 10 CFR 50.36 regarding SLs, LSSS, LCOs, SRs, Design Features, and Administrative Controls
- Meet requirements of 10 CFR 50.36a on radioactive effluents
- Conform to STS conventions regarding format and usage rules
- Consistency with ESBWR design and accident analyses as described in DCD

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Open Issue Resolution:

- **COL Information**

  Bracketed plant-specific TS (PTS) information that COL application must include to complete PTS

  – DC/COL-ISG-8

  – DCD Table 16.0-1-A and reviewer's notes

  – LSSS - Setpoint Control Program specification:

    - Instrumentation Setpoint Methodology accepted by ICE2

  – Post-Accident Monitoring Instrumentation Program specification

    - Regulatory Guide 1.97, Revision 4

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Open Issue Resolution:

• SRs for Digital Instrumentation and Controls

Instrumentation Functions

- Channel Check
- Channel Functional Test
- Channel Calibration
  Setpoint Control Program

➢ Response Time
  Staggered Test Basis

Actuation Functions

- LSFT
  Overlaps with SR to verify actuation on an actual or simulated signal

➢ Response Time
  Staggered Test Basis

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Open Issue Resolution:

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Actuation Functions

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➢ Response Time
  Staggered Test Basis

Open Issue Resolution:

- **SR to measure drywell-to-wetwell bypass leakage**
  - Each wetwell-to-drywell vacuum breaker and vacuum breaker isolation valve leakage is ≤ 15% of design basis $A/\sqrt{K}$ (equivalent to 2 cm^2)
  - Total wetwell-to-drywell vacuum breaker and vacuum breaker isolation valve pathway leakage is ≤ 35% of design basis $A/\sqrt{K}$
  - ➢ Overall suppression pool bypass leakage is ≤ 50% of design basis $A/\sqrt{K}$

Open Issue Resolution:

- **Control Room Habitability Area temperature post-DBA**
  - LCO 3.7.2 requires maintaining heat sink temperature "within established design limit" (SR 3.7.2.1) (CRHA thermal analysis)
    - ≤ 74 °F for CRHA
    - ≤ 78 °F for Q-DCIS & N-DCIS equipment rooms
    - ≤ 104 °F for HVAC equipment rooms and safety portions of CRHAVS
  - CRHA boundary passive heat sinks limit the CRHA temperature to the acceptance criterion of 33.9°C (93°F) for 72 hours post-DBA with no internal forced air recirculation or cooling.

Conclusion

ESBWR generic TS and bases comply with 10 CFR Sections 50.34, 50.36 and 50.36a.

Therefore, DCD Chapters 16 and 16B are acceptable.

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Discussion/Subcommittee Questions