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# Official Transcript of Proceedings

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Subcommittee on ESBWR Col Application

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## UNITED STATES NUCLEAR REGULATORY COMMISSION'S

## ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

October 21, 2008

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

SUBCOMMITTEE ON THE ESBWR COL APPLICATION

MEETING

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TUESDAY, OCTOBER 21, 2008

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The meeting came to order at 1:00 p.m. in room T2B3 of White Flint Two. Michael Corradini, chairman, presiding.

PRESENT:

MICHAEL CORRADINI CHAIRMAN
CHARLES H. BROWN MEMBER
JOHN W. STETKAR MEMBER
WILLIAM J. SHACK MEMBER
J. SAM ARMIJO MEMBER
DENNIS C. BLEY MEMBER
JOHN D. SIEBER MEMBER
GRAHAM WALLIS CONSULTANT
THOMAS S. KRESS CONSULTANT
HAROLD VANDERMOLEN DFO

TABLE OF CONTENTS

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

1:01 p.m.

CHAIRMAN CORRADINI: The meeting will now come to order.

This is a meeting of the Advisory Committee on Reactor Safeguards Subcommittee on the ESBWR.

My name is Mike Corradini, Chairman of the Subcommittee.

The Subcommittee members in attendance are Sam Armijo, Dennis Bley, Charles Brown -- somewhere, Bill Shack, John Sieber and John Stetkar. And Tom Kress and Graham Wallis are consultants to the Committee.

The purpose of this meeting is to discuss Chapter 14 of the Safety Evaluation Report with open items associated with the ESBWR design certification application.

The Subcommittee will hear presentations by and hold discussions with representatives of the NRC staff and the ESBWR applicant General Electric Hitachi Nuclear Energy regarding these matters.

The Subcommittee will also gather information, analyze relevant issues and facts and formulate proposed positions and actions as appropriate for deliberation by the full Committee.

Harold VanderMolen is the Designated Federal Official for this meeting.

The rules for participation in today's meeting have been announced as part of the notice of this meeting previously published in the *Federal Register* on October 3, 2008.

Portions of this meeting may be closed to protect information that is priority to GEH Nuclear Energy and its contractors pursuant to 5 USC 552(b)(c)(4).

A transcript of the meeting is being kept and will be made available as stated in the *Federal Register* notice.

It is requested the speakers first identify themselves and speak with sufficient clarity and volume so that they can be readily heard.

We have not received any requests for members of the public to make oral statements or written comments.

Just to let everybody know, we are in our final stages of doing a chapter-by-chapter review. The final chapter, Chapter 7 will be rescheduled at another time for us to meet with the staff and the applicant to learn more about their position there.

Let me proceed with the meeting. I'll call upon Eric Oesterie to kick us off today. Eric?

MR. OESTERIE: Thank you Dr. Corradini.

I'm Eric Oesterie. I'm the lead project manager for Chapter 14 on the staff in the Office of New Reactors, Division of New Reactor Licensing in GE1 Branch.

This afternoon we're going to hear about the initial test program, that's Section 14.2 of the ESBWR DCD. GEH will provide us a presentation of what they've provided in their DCD. And following that presentation the staff will provide the results of their review of GEH's initial test program for the ESBWR and present the findings of their Safety Evaluation Report with open items.

Following that I will provide an overview for the ACRS Subcommittee on Tier 1, Tier 2, Tier 2 star and design acceptable criteria as used in design certifications. And that's in preparation for the presentations that we'll be hearing tomorrow morning from GEH on tier 2 Section 14.3 which discusses their methodology and selection criteria for putting systems, structures and components into ITAAC and the entire Tier 1 document that they have. And also you're hear a presentation on the staff's review of GEH's ITAAC for the ESBWR tomorrow morning.

At this time I'd like to turn it over to GEH for their presentation on 14.2.

MR. DAHLGREN: Okay. Good afternoon. My name is Chris Dahlgren. And I'm here to talk about the initial test program for the ESBWR.

I work in the Plant Performance Group for GE Hitachi under Wayne Maraschino. And my background is basically I have a degree from University of Maryland in nuclear engineering, a degree from Royal Institute of Technology in Stockholm in mechanical engineering. And I worked at Palisades Nuclear Plant in Michigan for eight years in reactor engineering safety analyses and also as a senior reactor operator.

So I'm pleased to be here today. It's a great honor to discuss this with you guys.

And the role as a start up engineer is to basically know a little bit about everything, but everything about anything. I'm going to try to discuss the topics that I've chosen today as far as I can take it. But I think a lot of these subjects that you're going to notice, we're going to have separate meetings or we've already discussed them in detail. So at some point my expertise will end and we'll have GEH experts go delve deeper.

With that said, today I'm going to talk about the initial test program for the final safety analysis report. That's the official title of the SRP Section 14.2.

The ESBWR initial test program is based on the ABWR initial test program. It's also based on RG 1.68 rev. 3.

The initial test program includes preop and startup testing. And I do have a slide a little bit later where we basically define the different stages of testing of a nuclear plant. And a lot of people use startup, preop and construction testing. And everyone seems to have a picture in their mind what they mean, but it's really quite clearly defined in the RG.

I want to spend some time talking about the first of a kind testing that we have proposed for the ESBWR. Because I would imagine that you guys would be interested in seeing what we have proposed.

Also, we're going to spend some time

looking at what COLA applicants will provide to the staff for review.

And, of course, a summary.

So 14.2 section overview. 14.1, by the way, has been deleted from the SRP so it doesn't exist. 14.2 includes both test descriptions for both preop and startup testing and it includes program requirements for the whole initial testing program including organization, staffing and procedure requirements.

CONSULTANT WILLIS: Can I ask you a question?

MR. DAHLGREN: Yes. Go ahead.

CONSULTANT WILLIS: I'm sorry to interrupt you so early.

I read the documents and they contain a lot about description.

MR. DAHLGREN: Yes.

CONSULTANT WILLIS: And a lot about organizational, staffing and procedures. But the reg guide requires that you describe technical aspects in sufficient detail to show that the test room will adequately verify the functional requirements.

MR. DAHLGREN: Right.

CONSULTANT WILLIS: I didn't find anything in the document about how you're going to adequately verify functional requirements or even what these functional requirements are going to be.

And later on in another RG 1.68 it says you should provide validation to the extent practical, which of course if very open ended.

MR. DAHLGREN: Yes.

CONSULTANT WILLIS: But the analytical models and assumptions used to predict plant responses to anticipated transients and postulated accidents I didn't see anything in the documents about how your test will help you provide validation of analytical models and assumptions in responses to accidents.

MR. DAHLGREN: Yes.

CONSULTANT WILLIS: So I don't quite know what this program is all about since it doesn't seem to address these key issues picked out of the regulatory guide.

MR. DAHLGREN: Well, I can --

CONSULTANT WILLIS: Sorry to --

MR. DAHLGREN: No, not a problem. This is why I'm here.

CONSULTANT WILLIS: And that's very

striking when you read the document.

MR. DAHLGREN: Yes. I'm here, and that's why I'm here to answer your questions. I don't have any problems with that at all.

How I say that to you it's basically all these tests, especially I think you're talking mostly about the big tests over the hole plant, the entire plant tests towards the end during the startup phase after fuel has been loaded into the core that's where you're going to see.

CONSULTANT WILLIS: I'll take an example. And for instance you're going to do a PCCS test. Well, that's a big thing.

MR. DAHLGREN: Yes.

CONSULTANT WILLIS: There's nothing in here that tells you what you're going to test and who you're going to test and what results you expect.

MR. DAHLGREN: There's not.

CONSULTANT WILLIS: And how you're going to interpret it.

MR. DAHLGREN: Okay. Well, I would have to disrespectfully disagree -- or respectfully disagree. I'm sorry. I'm so sorry.

CONSULTANT KRESS: Either way. IT

doesn't matter. You don't have to do it respectfully.

MR. DAHLGREN: I'm sorry about that. I really am. I mean respectfully disagree.

And, in fact, for the PCCS testing I do have a slide later which discusses actually what we're going to do for the PCCS and for GDCS and for slick system and for the intercondensor cooling system -- no. Isolation condenser cooling system. So we have basically if you get that impression from reading Section 14.2, I hope that my presentation and maybe I can discuss with you later, I can show you that we actually have details in there.

I do agree, though, and this is a conscious decision from us that we tried to keep 14.2 general in nature. Because we know that details of the design will progress, but at the same time there are very specific test acceptance criteria in 14.2 and in the ITAAC. So already we have bounded a lot of these tests. And I guess I can bring that up right now even though I'm not the ITAAC expert.

14.2 can refer to the ITAACs, whereas ITAACs cannot refer back to 14.2

MR. OESTERIE: Can I jump in here just a second? This is Eric Oesterie from the staff.

One of the things that I think needs to be mentioned here is that 14.2 the initial test program is connected very much so with COL applicant responsibility to complete the program and provide the necessary details for those testing procedures since they are the ones that will be implementing those procedures post licensing.

So what we're looking at is ensuring that there is sufficient description and basis in the DCD to allow the COL applicant to fully develop the initial test program with GEH's assistance.

MEMBER BLEY: I'm sorry.

CHAIRMAN CORRADINI: Go ahead.

MEMBER BLEY: I just wanted to follow that up based on Dr. Wallis' statement.

Where then do you look to see if they're addressing the issues Dr. Wallis raised earlier if it's not 14.2?

MS. CUBBAGE: You mean at the design certification stage?

MEMBER BLEY: Yes.

MS. CUBBAGE: Basically you look at --

MEMBER BLEY: That the right things to test all these functional requirements are in fact built into the test program?

MS. CUBBAGE: I think in 14.2 we're looking at adequate coverage of the complete scope of the plant and then the detailed procedures of how that's implemented are a COL applicant item.

We can get into that more when the staff has their presentation.

MEMBER BLEY: Okay.

MS. CUBBAGE: If you want to let him proceed.

MR. DAHLGREN: Like I said, I have slides on those unique design features of the ESBWR nd what we're planning on testing. We can discuss it then.

CONSULTANT WILLIS: I see you answered my question by specific examples.

MR. DAHLGREN: Yes, I think so. You know, you may still disagree but I have more details later in the presentation.

CONSULTANT WILLIS: So you were aware that something was missing in the document?

MR. DAHLGREN: No, no, no. This is right out of the document. What I'm saying here is out of the document.

Okay. Anyway, that's enough on that slide. Sorry.

14.2, I've said this already so I'm just going to move ahead. This is where definitions are important and we have that problem still without our own organization at GEH. People talk about startup testing, preop testing. RG 1.68 rev. 3 only deals with preop testing and startup testing. And preop and construction testing there is a definite turnover stage on a system-by-system basis and area-by-area basis. And construction testing is not covered by the DCD Section 14.2 and also not covered RG 1.68 rev. 3.

CHAIRMAN CORRADINI: So just to clarify there. So I guess I'm going to keep on asking this question, and it's not to you but it's to everybody. I want to reflect back to when things were built before and how things were built before relative to procedure. So this is not different. Construction testing is simply a test whereby, at least as I remember it, the construction test says yes it works good enough that the operation staff can then do their approved procedural preop tests on it.

MR. DAHLGREN: Yes.

CHAIRMAN CORRADINI: So there is nothing in any of the DCD on construction testing. That';s an internal test, is it not?

MR. DAHLGREN: No. 10.1 has a lot of the construction testing.

CHAIRMAN CORRADINI: Okay.

MR. DAHLGREN: Especially wall thicknesses and layout. The general arrangement of the system shall be per the table and the picture of the ITAAC. So that means after the pump you have a discharge valve. After the discharge valve you have a heat exchanger. After the heat exchanger -- the heat exchanger has all these connections, you know, so that's construction.

CHAIRMAN CORRADINI: Let me just take an example of an old system and just to reflect on these. I want to understand this so I don't ask incorrectly.

So in construction testing they may might turnover a safety injection system for PWR and all they would essentially do is turn it on, verify the pump curve, verify the valves are all where they're supposed to be, that is all check valves are pointing the right direction, da, da, da. Essentially verify the pump, but then turn it to the operational staff which has a very specified set of preoperational testing procedures for the safety injection system?

MR. DAHLGREN: It's actually --

CHAIRMAN CORRADINI: So 14.2 only covers the second?

MR. DAHLGREN: That's correct.

CHAIRMAN CORRADINI: But does have generalized descriptions of the former?

MR. DAHLGREN: Correct. And also I want to clarify a little bit. There's going to be a construction team and there's going to be a preop team. The preop team will depend on the contract, you know who is building this plant. But for now let's say it's GEH running the preop testing program.

We have a definite list of things that we -- we work it down, we walk the system down with construction crews. They flushed it, they've run it, they've pumped the pumps, they've basically moved all the valves. The valves all move freely. They've tried to set up the system so that at least it's ready for testing. It's not operational by any mean probably.

And then the preop testing group will go and we'll do the component testing to make sure all the valves work exactly the way we want it to work. And then we'll start doing our integrated flushing,

our integrated system testing where we have pump
curves and so forth.

And I want to bring up a different point with these plants, and hopefully I don't get too far into this. But in the old days they were all basically analog controlled so you could go and run everything locally as you were building it. In this plant we have the DCIS which is a digital control system which has to be in place before we run a lot of these systems together.

So what happens there if you don't realize it up front that your whole testing sequence is kind of backwards from the old days. You can't have crews out there running their systems independently because it's all controlled by this big DCIS system, N-DCIS or Q-DCIS. So it's a big change from how we used to do -- well, not me. But how people have done things in the past.

CHAIRMAN CORRADINI: So individual testing you described or you just referenced would have to wait until the complete the DCIS is tested?

MR. DAHLGREN: Yes.

CHAIRMAN CORRADINI: And then it would be used to test components and subsystems?

MR. DAHLGREN: Right. What's going to

happen is early on the plant we're going to have the control building built, DCIS that are ready and then we're going to start bringing these remote multiplexing units in service one-by-one. And it's going to be driven really early in the schedule because it's going to basically turn into a support system just like CCW, component cooling water, service air, instrument air, fire protection.

CHAIRMAN CORRADINI: But if I just one more analogy and then I'll stop and I'm sure somebody else will pick up. What you're really saying is before historically when you would start up a plant you would do the fluid systems first. What you're saying is the first system you bring on line is an integrated system would be the DCIS?

MR. DAHLGREN: The very same.

CHAIRMAN CORRADINI: Before you start testing your fluid systems?

MR. DAHLGREN: One of the very first ones.

CHAIRMAN CORRADINI: Okay.

MEMBER ARMIJO: Now isn't that what was done with the initial EBWRs in Japan?

MR. DAHLGREN: That's correct, yes.

MEMBER ARMIJO: So you have experience

with that approach?

MR. DAHLGREN: Yes, we do have experience. Yes. There are people sitting next to me that have done it.

MEMBER ARMIJO: Okay. And you're incorporating that into your test planning?

MR. DAHLGREN: Yes. Absolutely. Yes. We're basing a lot of this on both the Lungmen and the Japanese plants that are in progress. The Lungmen plant is in startup right now, startup phase.

MEMBER BLEY: A functional question. Is it that you can't start the equipment locally without the DCIS or is that you want to exercise the whole interface?

MR. DAHLGREN: Well, that's a good question.

MEMBER BLEY: Thank you.

MR. DAHLGREN: Well, because we've discussed that a lot, actually. What do we let the construction people do without the control system in place. Because the control system controls the equipment, it also protects the equipment. You know, it would have the low suction pressure trip or, you know, high. So those types of protections will not be available until you have a DCIS functioning. However, you want to probably --

MEMBER BROWN: All the eggs are in basket? Am I missing something here.

MR. DAHLGREN: Say that again.

MEMBER BROWN: All your eggs are in one basket? If that's not working, nothing works?

MR. DAHLGREN: Well, N-DICS doesn't work, then nothing works. Well, nothing that's supported by N-DCIS.

I don't want to get into how redundant and how stable and well built the DCIS system is.

CONSULTANT WILLIS: Like testing a hound without a brain or something?

MR. DAHLGREN: Well you don't run a pump if you don't have cooling to a pump, right? If you don't have cooling to a pump or heat exchanger, you don't run it. Why would you run the pump if you don't have the control system that will trip the pump? But it depends on the situation.

We're still working on the actual, this dot here between construction and preop is probably more like a band. And we're still working on, okay, where's this thing going to be. And we want the construction team to at least have bumped -- if you know what bump is; run the pump to see that you've actually hooked it up right. We want the construction to have at least manipulated all the valves so that they're not locked up. So we want to them have flushed the system so they're clean.

CONSULTANT WILLIS: See if water comes out --

MR. DAHLGREN: Right. We want to leak check to --

CHAIRMAN CORRADINI: And other things don't come out.

MR. DAHLGREN: Right. We want to also leak check these systems and flush with skids to make sure that when preop takes them we're not going to just go right back to construction and say fix all this stuff.

MEMBER BLEY: Well the DCIS system has to be there so all your pumps flush, all your pipes flushing, all systems --

MR. DAHLGREN: It can be done with skids.

MEMBER BLEY: Do you need the DCIS for that?

MR. DAHLGREN: We may need, we may not. This is a longer discussion. If we can do it without DCIS, we will because we can do it with skids with respect -- a flushing skid would have the pump, power supply, a water supply.

MEMBER BLEY: Separate, something different from the operational --

MR. DAHLGREN: Correct, but you can hook into the system and run through all the fluids and collect all the fluids at the end because you can't just drain them. You know, it has all that metal waste and you may flush with different agents that you don't want to go out in the drain. So they have these flushing skids that you can bring out to do this stuff. But, like I said, we're still working on this. There's quite a few people involved, too, in deciding where we're going to place these things.

MEMBER BLEY: Back to my question.

MR. DAHLGREN: Yes.

MEMBER BLEY: If I understood you right, you might be able to start the equipment locally but you really don't want to do that because none of the protection --

MR. DAHLGREN: I would only do it to verify that what you just did is correct. You don't want to turnover your system to preop and the pump is running backwards.

MEMBER STETKAR: Can I ask you question? Because when Dr. Wallis asked you earlier about sort of his generic concerns about the testing program you said well you hoped to alleviate some of those concerns by specific examples that I noted were very focused examples for mechanical systems. Do you have examples of how you're going to test the DCIS? Because in both DCD Section 14.2 and in the DAC and ITAAC everything that I can read is so general that you could pretty much plug in anything that might or might work in there and satisfy those criteria.

So I'd be interested to hear more details about the testing program for DCIS than what I can read.

MR. DAHLGREN: Okay.

MEMBER BROWN: They're all like that.

MEMBER STETKAR: No. Some of the fluid systems are actually a little more specific about flows and temperatures and stuff like that.

MR. DAHLGREN: I think we fool you. I mean it looks --

MEMBER BROWN: It looked like that to me when I read it.

MR. DAHLGREN: I mean if you read it real quick, you feel like you didn't get any details. But if you go through it --

MEMBER STETKAR: Well, yes. And I guess I'm just asking for some help to point me to places where the details are.

PARTICIPANT: Maybe we have some gentlemen here GEH that may be able to help.

MR. WACHOWIAK: Rick Wachowiak from GEH.

One of the reasons why you're not seeing a lot in the I&C systems is associated with something that Eric will be talking about later this afternoon, the design acceptance criteria. By its nature those systems don't have the same level of detail in the DCD because we expect to be able to plug in, you said anything but it's not just anything. It's anything that will meet all of the requirements.

It was recognized many years ago that the digital I&C world, the computer world is moving much faster than we are with some of these nuclear plants. And we wanted to be able to take credit for at least somewhat recent technology in the digital world with these plants. So the design acceptance criteria was allowed in fast moving technology like digital I&C.

So we lay out what the requirements are for the design and later in the process we will have the design information ready and will be submitted as one of the DC ITAAC to the staff which will approve at that point in time. And then we would test it with the other more general criteria. But you would have at the time you satisfy the DC is when you would specify the more detailed testing.

MEMBER STETKAR: I guess I'll wait to hear a little more about it.

MR. DAHLGREN: And that's at the end and then we'll hear more about that.

MEMBER STETKAR: Okay. Yes. Thanks.

CHAIRMAN CORRADINI: Keep on going.

MR. DAHLGREN: Unfortunately, I don't have any of the DCIS testing as part of this presentation. It will be covered.

Anymore questions on this slide? It's just I wanted to just make sure that we know what preop testing is. Yes, I haven't talked about this slide.

Preop testing is while we do not have fuel in the core. And so preop testing is basically tests that occur before fuel load. And startup testing are tests that occur after fuel load. And of course, then we have the big item at startup testing is tech specs, because then we have tech specs, here we do not. Okay. That's a key: tech specs, no tech specs.

And operations, control room, not anybody but someone sanctioned to do testing. Doesn't necessarily have to be operations.

CONSULTANT WILLIS: So you are going to do the DCIS testing before you put fuel in?

MR. DAHLGREN: Right.

CONSULTANT WILLIS: Which seems to me you can then find the water comes in but you can't say what it does to a core because there's no core there.

MEMBER SIEBER: So you can't --

CONSULTANT WILLIS: Can't even see if it flows through the core.

MEMBER SIEBER: Right.

MR. DAHLGREN: But.

CONSULTANT WILLIS: A very restricted test. You're going to tell us all about it when you get there?

MR. DAHLGREN: I will tell you all about it, and then you can tell me what you think.

CONSULTANT WILLIS: It looked to me as

if it's just opening an valve and seeing if water comes outs.

MR. DAHLGREN: Okay. We'll talk about it. Maybe have some insight I haven't thought of. That would be great, actually.

Okay. Preop testing objectives.

Demonstrates system structures and components operability prior to fuel load. So the final stage of a preop test is to say, okay, it meets all of our acceptance criteria and basically set the clock for surveillance requirements for the tech specs. So once it's declared operable, you basically start surveilling it per the tech specs.

CONSULTANT KRESS: Where would we find those acceptance criteria?

MR. DAHLGREN: They are both in Chapter 14.2 and in the ITAACs.

CONSULTANT WILLIS: They're there?

MR. DAHLGREN: Yes.

MEMBER BROWN: There's no real acceptance criteria that I've been able to find.

MR. DAHLGREN: Well, 14.2, like I said, kept it very general.

MEMBER BROWN: Well, yes. It says I'm going to verify that something talks to something or

-- I mean just you can pick anyone of these and they're boiler plate.

MR. DAHLGREN: Yes.

MEMBER BROWN: I'm going to calibrate my instruments. Well, that's nice. Proper functioning of sensors and monitors.

MR. DAHLGREN: If I say proper functioning of sensors, so what's the more detailed version of that? In test 4 in a licensing stage, we're not in a final design stage of the design. I mean, that's just something to keep in mind.

CONSULTANT WILLIS: Well the fluid systems, let's say DCIS.

MR. DAHLGREN: Yes.

CONSULTANT WILLIS: Now you can open a valve and water comes out.

MR. DAHLGREN: Sure.

CONSULTANT WILLIS: Now there must be some criterion that says a certain amount of water.

MR. DAHLGREN: Yes, we have accept flow rate. It's in ITAACs.

CONSULTANT WILLIS: It's in the ITACCs somewhere?

MR. DAHLGREN: That's correct, yes.

CONSULTANT WILLIS: There's actually a

number in there?

MR. DAHLGREN: Yes, there is.

CONSULTANT WILLIS: Well, maybe I missed it.

MEMBER BROWN: In Tier 1?

MR. DAHLGREN: Yes.

MEMBER BROWN: Or in Tier 2?

MR. DAHLGREN: In Tier 1.

MEMBER BROWN: In the chapter --

MR. DAHLGREN: The numbers are normally not in Tier 2. They're in Tier 1.

MEMBER BROWN: That's Chapter 1 of the DCD?

MR. DAHLGREN: No, Tier 1 is a separate document.

MEMBER BROWN: Oh. I just saw Chapter 1 said Tier 1 on it.

MR. DAHLGREN: No. That's --

MEMBER SIEBER: The approach is similar to what's been used on all the current reactors.

MR. DAHLGREN: Okay. And there is a really good reason for doing it that way.

MEMBER STETKAR: There's no other way to do it.

MR. DAHLGREN: Right. And ITAAC becomes

the ruling document. And so the ruling document will be cast in basically concrete and the Tier 2 will just refer to it. I mean Tier 1 will definitely drive your testing acceptance criteria. Tier 2 just tells you how to accomplish some of these tests. Because --

MEMBER SIEBER: The details of the specific tests, you know tests that would verify flow that include things like the reactor core, are done in the startup phase of testing. And that's because the system is assembled. And what you do is take the tech specs and you go down through all the requirements for certain flows and temperatures and pressures to meet the design criteria. Those are in the tech specs and there are surveillances there that say you should run this pump to determine that you have a certain shutoff head at a given temperature and suction pressure.

And so basically that's the way those tests are run. But there are certain things that you can't verify by tests very easily. One of them is the natural circulation for decay heat removal or the gravity operation. Unless you cause an accidents, there's no way to do it.

CONSULTANT WILLIS: And then there's the

question of the strainers. How are you going to test these strainers about which there's very little--

MEMBER SIEBER: You do that --

CONSULTANT WILLIS: They're supposed to catch debris. Are you going to catch debris?

MEMBER SIEBER: You test them outside of the plant.

CONSULTANT WILLIS: Test them outside. You must do that.

MEMBER SIEBER: And then you say this is the kind of debris that you're going to get. And when you do that given flow at pressure this is the--

CONSULTANT WILLIS: So there's a whole lot of logic about what you do before you build the plant at all and how that ties in with these tests.

MEMBER SIEBER: That's right.

CONSULTANT WILLIS: Which is missing. It must be there somewhere, but we haven't got it here.

MEMBER SIEBER: That's right.

MEMBER SHACK: But your flow tests are design commitment 8A and 8B in the ITAAC for the DCS.

MR. WACHOWIAK: That's correct. And the numbers are not in Tier 1. We would expect that when the actual test procedure is written in that test procedure you need to do some scaling for this particular one. Because the plant will not be in the same sort of pressure and temperature conditions as in the design basis accident. It'll be in a depressurized open vessel situation. And the development of that procedure will have to take into account the as-built isometrics and the rest of the piping. And it will have to be a scaled test to demonstrate the right flow. So for that particular case the flow rate is not in Tier 1 because we recognize that it's more complicated than just having a pump flow rate in there.

In other cases where we have a pump in some of the non-safely related but covered by RTNIS, then the flow rate for the pump is actually in Tier 1 because that's a straightforward test. This ones a more complicated test than just having a number.

CONSULTANT KRESS: When these test procedures are actually written are they submitted to the staff for approval?

MR. DAHLGREN: That is a Col Holder item. And it will be 60 days before the test is going to take place in a prop phase. And the startup tests will be provided to the staff 60 days before we start loading fuel. So the whole startup testing program will be --

MS. CUBBAGE: It's not in review and approval mode. It's provided for information. Because after we've issued the license --

CONSULTANT KRESS: What if --

MS. CUBBAGE: Well, then there's a reason for submit space. If there was an issue, an inspection space. But once we've issued the combined license, we're not in the mode of receiving anything for review or approval that's required for the plant to come on line other than the ITAAC verifications which Eric will start you out on this afternoon.

MEMBER SHACK: Okay. But the ITAAC verifications will be reviewed and submitted??

MS. CUBBAGE: Well, I mean there's a condition on the license. It's a conditional operating license so the ITAAC have to be fulfilled before we can allow them to authorize them to load fuel. But as far as any other to-dos coming out of this, for example the submittal of the procedures, it's for info, not for review and approval.

CHAIRMAN CORRADINI: But the approval or the completion of the ITAACs is for review and approval?

MS. CUBBAGE: Well, it's an inspection. We're in an inspection program at that point. Construction inspection program.

MR. OESTERIE: Yes. There are regulatory requirements on the part of the licensee to submit what we call ITAAC determination letters that document there are successful completion of ITAAC. And the staff reviews those. And the staff also has a regulatory requirement to post a notice in the *Federal Register* either agreeing or disagreeing with the COL claim on successful completion of ITAAC.

CHAIRMAN CORRADINI: But just to clarify. But that's the point when then from, as you said, the inspection process will begin you would select whether it be a test of physical inspection or an analysis to audit and check on some basis, right, as we have discussed last year sometime in fact on the procedure you're going to use for it? Do I have that?

MR. OESTERIE: Right. In fact, that effort is ongoing right now for some of the other design certifications. I think we'll start for ESBWR soon where our construction and inspection of folks will start looking at all of the ITAAC and then assessing them and grading them so to speak. And then they've got a formulation where they put into a black box and out comes some output that identifies to the staff what the smart sample set is for direct inspection, of which the staff will get the most value for their effort in performing these direct inspections. And which inspections will be most revealing in terms of giving them information on the adequacy of the construction progress of the plant.

MEMBER BLEY: Okay. All this is done in the regions, right?

MR. OESTERIE: It's a combined effort, headquarter staff and regional staff.

CHAIRMAN CORRADINI: They did present this to us prior I think to you coming on. It's a combination of headquarters helping the region and particularly inspectors that have had the experience, if I remember correctly.

MR. OESTERIE: That's correct, yes. And once it does get implemented it will be performed out of the construction inspection office out of Region II, the New Plant Construction Inspection Office.

CHAIRMAN CORRADINI: Moving along.

MR. DAHLGREN: Okay. I just wanted to give you some bullets of what we're trying to accomplish in the preop testing here.

So it demonstrates system structures and components operability.

WE use the plant procedures that are later going to be used for surveillance procedures to make sure that we've exercised them and vetted them, and make sure that we have a good set of procedures by the time we're done preop testing. I'm sure we'll find things as we test all these systems, problems with our procedures.

And at the same time we'll also give the opportunity for the plant staff to get practicable experience and on-the-job training in operating the equipment and learning the equipment.

And we have 64 tests that we described in Section 14.2.

MEMBER ARMIJO: What's the approximate amount of time that you'll be in preop testing? Six months, a year, what?

MR. DAHLGREN: Between six months and a year. We're working on the schedule right now. And we're trying to come up with major milestone and tie it all time. But that's the time frame we're looking at.

CHAIRMAN CORRADINI: Let me ask this question because it's going to come up later, so we might as well just lay it out there. Is there something about the very first ESBWR that will be done? You have first of a kind for systems. Will be first of a kind tests for the first ESBWR that once done doesn't need to be done for additional ESBWRs?

MR. DAHLGREN: Yes.

CHAIRMAN CORRADINI: So we'll get to that?

MR. DAHLGREN: Yes.

CHAIRMAN CORRADINI: Okay. Thank you.

MR. DAHLGREN: Startup testing also has objectives, obviously. And that's following fuel load. Now tech specs are in place. And what we want to achieve is an orderly and safe initial fuel load. An orderly and safe initial criticality. Low power physics testing, obviously. Initial heatup and orderly safe power ascension. And we have 34 tests described in the DCD for the startup phase with fuel in the core.

MEMBER SHACK: Could you step back a

little back?

MR. DAHLGREN: Yes.

MEMBER SHACK: In the preop testing before you load fuel is there anyway to get the system hot? You don't have recirc pumps.

MR. DAHLGREN: Correct. That's a slide coming up. ESBWR initial startup will be unique, and that is a first of a kind test also for the first unit is to make sure that our method of heating the plant the first time that we validate that our design assumptions are correct.

MEMBER SIEBER: Yes. I'd like you to do that in some detail so I can understand it.

MR. DAHLGREN: For the startup testing we have five test plateaus that we've identified:

Opening vessel testing which is initial fuel loading and other tests, control rod testing.

Testing during nuclear heatup to rated temperature and pressure, which is less than five degrees which we just discussed. This is with the head on and how we're going to heat up this thing without decay heat for the first time. It's going to be interesting.

Power operation testing. We have them from five percent power, which is our mode one, by the way. Mode one to mode two is at five percent rated thermal power. And so in mode one we have lower power testing, which is 25 percent rated thermal power, medium power 50 to 75 percent and full power testing.

And to take a look at what we've proposed for the different plateaus, there's a table in the DCD. Table 14.2-1 that shows what startup tests are going to be performed at what power plateau or test plateau.

CONSULTANT WILLIS: Are any of these tests going to get close to the unstable region or possible unstable region?

MR. DAHLGREN: There are tests that are going to get close to the unstable region because we have the feed water temperature operating the main test. We don't intent to making the reactor unstable to see if it --

CONSULTANT WILLIS: But you can measure it?

MR. DAHLGREN: But we will measure the stability, yes. Yes. And I have slides on that coming up.

CONSULTANT WILLIS: About .25 or something?

MR. DAHLGREN: I have slides on it coming up and we can talk about it.

CONSULTANT WILLIS: So there's some testing sort of dynamic response?

MR. DAHLGREN: Oh, absolutely. Yes, absolutely.

CONSULTANT KRESS: You have a detect and suppress system on there?

MR. DAHLGREN: Sure.

CONSULTANT KRESS: How do you test that then? Do you actually put an artificial input into it?

MR. DAHLGREN: Yes. No, you don't have to put an artificial input even. You can do what's called an anticipated operational occurrence, for instance. You can simulate and anticipate an operational occurrence and measure stability during the reactor response. And we will have plenty of opportunity, as you will see, in our major transient testing that's proposed by this plant. We will trip feed pumps and we will do things like that that will introduce a signal that we could definitely check the decay ratio, for instance. Immediate flow changes in the core and so forth to see where it stabilized out.

MEMBER BROWN: In your transient testing do you do reactor transient for a group rods to check periods and stuff like that or is all just analytical?

MR. DAHLGREN: I believe -- well, no, it's not analytical. Well, we have for instance a test, I'm describing it later, but we do like a loss of feedwater heating test where we just take out a feedwater heater and see what happens. You know, where we end up on the feedwater temperature operating the main and how close we are to stability. And the response to loss of feedwater heating is based on how bad it was, the Scury SRI system, for instance, the select rod insertion. So we can then verify that the plants selectively inserts rod for our program, and that will definitely change the whole operating characteristics of the plant and it'll find a new stable steady state. And we'll then have our stability measuring instrumentation in place for those types of tests.

MEMBER BROWN: So you consider those type of tests as where you come up with the physics performance of the reactor for the core itself?

MR. DAHLGREN: Yes. But we also have--

MEMBER BROWN: So it's just a plant dynamics?

MR. DAHLGREN: Right. I think it's a combination of both. I mean, we were going to test normal operations of the plant, too. Like fairly rapid power ascensions and coming back down again in power, and not load follow per se but testing our automation system. Not in load follow mode. But, for instance, if you wanted to come down to, say, 60 percent over the weekend to do some maintenance, this plant is capable of doing that with automation and we'll perform those tests as well in the startup phase.

Does that answer your question? I'm not sure it did.

MEMBER BROWN: Yes, I'm not sure either. So the low power stuff when you're at what I call zero power, one or two percent, whatever it is where you're not really running the plant you're feeding on the -- and stuff like that, you don't do the basic set of physics testing to determine --

MR. DAHLGREN: Oh, yes, we will do low power physics testing. Oh, definitely. I'm sorry. Yes, it's on the previous slide. Low power physics testing.

MEMBER BROWN: Well, I was reading the 689 page Tier 1 document at the time.

MR. DAHLGREN: I'm not sure where it's in in there. It's in our startup testing program.

I mean the core designers will give us acceptance criteria for the startup testing, low power physics portion. I don't know where that ends up in ITAACs, but we can discuss that in the afternoon.

MS. CUBBAGE: No physics test because you can't load fuel until you finish the ITAAC.

MR. DAHLGREN: Forget that sometimes.

CONSULTANT WILLIS: Low power physics testing, that's neutronics, is that what it is?

MR. DAHLGREN: Yes. Basically -- it's called -- in a plant where it's called low power physics testing, LPPT and it's basically that your rod groups are worth what we think they were worth, the temperature quotations are what they think they were and so forth. It's actually also a test that you loaded the core correctly because if you have a big anomaly you can detect whether you have a loading error. That's your first opportunity to really detect that.

CONSULTANT WILLIS: There's a lot of

things under physics then?

MR. DAHLGREN: Yes. Yes. I'll show you. Right now I can just tell you what we do for each of these plateaus.

We will do a core performance analysis, which is basically using the 3D monocore system to make sure that we have a power flow map that we expected. That we have our minimum ratio for critical heat ratio, whatever, NCPR power ratio. Making sure that we don't violate any of those limits that we have set for our ourselves. And also for our linear heat generation rates.

And also we have steady state tests where we do the vibration testing. Thermal expansion testing where we measure, you know make sure that the pipes didn't grow so much that one of them is like butting up against the concrete wall.

CONSULTANT WILLIS: So for vibration you must have instruments that measure vibration?

MR. DAHLGREN: Yes, we do.

CONSULTANT WILLIS: Yes. It's normally in all reactors and --

MR. DAHLGREN: For the initial startup you have vibration instrumentation.

CONSULTANT WILLIS: You take them out

later on?

MEMBER SIEBER: No, they're portable.

CONSULTANT WILLIS: Oh, they're portable?

MEMBER SIEBER: Yes. You move them here, you move them there. It's a suitcase with a probe.

CONSULTANT WILLIS: But in something like a dryer, you put them in there?

MEMBER SIEBER: No.

CONSULTANT WILLIS: You don't put them in there? So you're only vibrating certain things?

MR. DAHLGREN: This is where my expertise gets a little shallow. We are intending on measuring reactor internal vibrations during the initial startup to make sure that everything has been put together right. I mean, we can detect a loose part in the reactor vessel. Now I don't know all the details on how that's going to be accomplished.

MEMBER SIEBER: That's typically done by physics looking at the neutron signal. And the other way is to with instruments and listen for rattling.

MR. DAHLGREN: Yes. And another thing we have to think about this for the startup of this plant. We have actually put into place a provision in the tech specs that we don't have to have the containment inert for the first period of time because we know we're going to have to do a lot of testing inside containment for the first startup.

So stability measurements. I have a couple of slides on that coming up and I'll attempt to answer your questions on that as much as I can.

Control system tuning. At all these different plateaus we'll set up the control system so you don't have wide swings on feedwater, for instance, or anything else. Try to figure out how to best tune these systems up so that they run stable.

We'll do system transient tests, which I have a different slide on later.

MEMBER BROWN: When you do control system tuning, do you do that at each of the 50 --

MR. DAHLGREN: Yes.

MEMBER BROWN: So you do it at each point?

MR. DAHLGREN: Yes, this is for each plateau.

MEMBER BROWN: Is there one point where you check where you want to say that one's the one that's going to take precedence over how we do it?

MR. DAHLGREN: Yes.

MEMBER BROWN: Because they all won't be the same.

MR. DAHLGREN: A 100 percent power.

MEMBER BROWN: Okay. So that's your measuring point?

MR. DAHLGREN: Yes.

MEMBER SIEBER: You want to avoid oscillations at every power rate?

MR. DAHLGREN: Yes. But if you have to pick. Maybe you pick a compromise, but you would definitely try to weigh it towards a 100 percent power because this plant is designed to stay at 100 percent power.

MEMBER BROWN: No, I understand that.

MR. DAHLGREN: Yes.

And we have system transient tests which will be things like shutting of a pump in the feedwater systems, and things like that. And major plant transients which could also be turning off a feedwater pump. But actually more like tripping the plant, making sure you can trip the plant from the alternate shutdown panel and so forth.

CHAIRMAN CORRADINI: Let me ask this

generally because I think it may come up later and you can postpone us until the end on this one.

MR. DAHLGREN: Sure.

CHAIRMAN CORRADINI: But the one thing you don't test is squib valves.

MR. DAHLGREN: We don't break the squib valves.

CHAIRMAN CORRADINI: You do not break the squib valves.

MR. DAHLGREN: But we test all of the lines.

CHAIRMAN CORRADINI: But you do check electrically up to the actual --

MEMBER SIEBER: That's right.

MR. DAHLGREN: We test the propellant and we test the flow path. So the propellant is the little explosive that we put in to shear the pin. We test those. And we test the firing logic. Because during a squib valve system test we will put in place a testing valve that will basically test the firing logic and open the valves instead of firing a squib valve. Because when you fire a squib valve you have to replace it.

CHAIRMAN CORRADINI: That would be the best you just spoke of. Because I remember we asked this of Rick. And I think that he explained it that way. That one where you replace the valve, that would be a construction test or a preoperational?

MR. DAHLGREN: A preop test.

CHAIRMAN CORRADINI: Yes.

MEMBER BROWN: Do we accept squib -- educate me. I mean so we operate a plant with a valve that is never tested operationally?

MEMBER SIEBER: No.

MEMBER BROWN: So you put it in and you don't know it'll work.

MEMBER SIEBER: It is factory tested.

MR. DAHLGREN: Yes.

MEMBER BROWN: So you blow it up there.

MR. DAHLGREN: Then you don't use it.

MEMBER SIEBER: You don't use it again. Once you operate, it's like testing a firecracker, you know. Once you light it and it blows up.

MEMBER BROWN: I understand that. But not all firecrackers go off, except the one in your hand.

MR. WACHOWIAK: This is Rick Wachowiak.

In existing BWRs now we have squib valves in the standby liquid control system and they have the same characteristics as the ones we're talking about here.

MEMBER BROWN: And I'm supposed to feel comfortable with that, right?

CONSULTANT KRESS: Do you do other tests on the standby liquid control system other than -- I mean, do you ever activate it to see the capacity?

MR. WACHOWIAK: Yes, we do.

MEMBER SIEBER: You mean inject?

MR. DAHLGREN: In preop phase we do with water.

CONSULTANT KRESS: Yes, that's with water into the --

MR. DAHLGREN: Yes. But the surveillance requirement in the tech specs it can done in pieces. So you never have to actually inject anything to the reactor vessel.

CHAIRMAN CORRADINI: So I didn't want to take you too far off track. You can go back to on track. But I guess the way you answered it, though, gets me back to the general philosophy which is even in currently operating reactors all explosively open valves once opened values have not been tested.

MR. DAHLGREN: No. We test the charge.

CHAIRMAN CORRADINI: May have been tested with some sort of -- you called a replacement.

MR. DAHLGREN: Yes, alternate.

CHAIRMAN CORRADINI: Yes, alternate surrogate valve.

MR. DAHLGREN: Yes. And there is a ASME standard for testing of propellant. And the requirements for if the propellent that you pulled out of this valve didn't fire, what do you need to do. And, of course, you have a past operability issue but also you have a testing program issue. You have to buy more propellant. You have to buy it from a different batch. You need to buy it from a batch that you knew fired. There's a lot of requirements falling in place once you have a propellant that doesn't fire.

We're also looking into getting propellants from two different manufacturers for common cause failures on the squib valves propellent.

CHAIRMAN CORRADINI: Thank you. Keep on going.

MR. DAHLGREN: Startup tests have to be available to the NRC 60 days prior to implementation. Actually, I think that may be slightly wrong. It has to be 60 days prior to fuel load. So, sorry about that. I'm very sure I actually have that incorrect here. I can check that.

So here we go. First startup we have to b at 80 to 90 degrees C to go critical and we don't have decay heat. So that's an ESBWR unique feature, so to speak, at least for the initial startup. Hopefully we'll have short outages and plenty of decay heat for the second startup.

MEMBER SIEBER: You assume.

MR. DAHLGREN: So what we have put into place is we have a fairly aux boiler that goes into the feedwater train and so we use feedwater to heat up the vessel and we use the reactor water cleanup system. Of course, waters grows and to overboard the water back to the condensation storage tank.

MEMBER SIEBER: What's the basis for the 80 or 90 degrees? It that the criticality?

MR. DAHLGREN: It's the NBT for the vessel mostly.

MEMBER SHACK: You want to keep the vessel ductile.

MR. DAHLGREN: Yes. You want to keep it chewy, a little bit not brittle.

MEMBER ARMIJO: Is that auxiliary

boiler, is that a permanent part of the plant?

MR. DAHLGREN: Yes. Yes, it is.

MEMBER ARMIJO: Okay.

MR. DAHLGREN: And it's also we can tie in additional we call them donkey boilers. But, I mean, basically more boilers and series so you can get a number of boilers into that injection path into the feedwater train.

MEMBER ARMIJO: I'm concerned about before you load the fuel --

MR. DAHLGREN: Yes.

MEMBER ARMIJO: -- get the plant up to temperature and pressure some way, at least some temperature --

MR. DAHLGREN: Yes, we have to. Yes.

MEMBER ARMIJO: -- before the startup you will do in your preop test you will use these auxiliary boilers and --

MR. DAHLGREN: We'll do a sort of a -- the vessel has to be first leak checked at the site, where its being made for an ASME stamp for Section 3. Then when it's placed in service or placed in the containment and welded up with all the pipes that goes through it we have to another hydro base and check the welds for it to pass at Section 11 of the ASME code.

MEMBER ARMIJO: That would be cold?

MR. DAHLGREN: No, it won't be cold. It will be coolish at 140 degrees.

MEMBER ARMIJO: And that will be with the auxiliary --

MR. DAHLGREN: Because we have to press it up to 125 percent of its assigned pressure before we load fuel. So we're going to --

MEMBER SHACK: So you don't do a cold hydro on site?

MR. DAHLGREN: That's what's called a cold hydro, okay, because it's not 420 degrees. But it's not cold. It's still going to be fairly warm. And it's going to be a challenge to get the whole vessel and all the water that warm. That's an engineering challenge ahead of us. Not a challenge. It's an engineering -- yes, it's going to be fun to get it going.

Okay. So now we get to the even more fun parts. We talk about first the of the kind tests.

First of a kind test definition per RG 1.68 is special tests assigned to prove features unique to ESBWR. We have a few of those. So I wanted to talk about this a little bit because I think Dr. Wallis will notice a couple of systems missing. And that's because they're not first of a kind tests because we're not just going to do for the first unit. We're going to do the test for the GDCS and the PCCS for all units. We don't have any specially assigned tests only for the first unit for those. We think that those tests are important enough --

CONSULTANT WILLIS: Well, they are unique features for ESBWRs?

MR. DAHLGREN: Yes. But at the same time, we don't have any tests that's going just validate that feature once. We're going to validate it for every unit built. So I'll talk about them right after this portion of the presentation.

Well, I've just listed them here and I'm going to talk about them individually.

The core performance vibration, pre-critical heatup with reactor water cleanup and shutdown cooling in service. That's the one I just talked about the aux boiler.

Isolation condenser system heatup and steady state operation. That's a key safety feature in the ESBWR's isolation condenser. And we are going to quite comprehensive tests on one of the four.

MEMBER BROWN: Why don't you test it every time?

MR. DAHLGREN: What?

MEMBER BROWN: So why don't you test every time then?

MR. DAHLGREN: We're going to test it.

MEMBER BROWN: If it's a key feature?

MR. DAHLGREN: It's a surveillance requirement to test these. But what this test is going to do is it's going to help us develop or help us know as-built the assigned information for the isolation condenser.

Power maneuvering in the --

MEMBER BROWN: Go back and answer that again.

MR. DAHLGREN: Okay.

MEMBER BROWN: Is the system going to be tested for each and every plant?

MR. DAHLGREN: Yes. The system is going to be tested. It's going to be tested in a specific manner for the first unit only.

MEMBER BROWN: Different than operational? I mean, I guess I don't understand why this is one of a kind if you're going to do it every time.

MR. DAHLGREN: If you wait a second. Right.

MEMBER BROWN: Because that's what you said in the --

MR. DAHLGREN: No. We have two different test sections for isolation condenser.

CONSULTANT WILLIS: Can you tell us what the test is looking for?

MR. DAHLGREN: Yes, it's coming.

CONSULTANT WILLIS: Is it looking for a certain amount of heat that's --

MR. DAHLGREN: Right. 33.75 megawatts thermal per unit. Yes.

Power maneuvering in the feedwater temperature operating domain we're going to pick points. We haven't picked points yet. We're going to pick points representing the points in the feedwater temperature operating domain, perform the stability measurements, perform the core performance analysis to make sure that we are indeed safe in our feedwater temperature operating domain the way we think we are safe. We are not challenging any limits or getting too close to any limits.

Automatic load maneuvering capability.

It's not a safety feature. It's just something that the plant can do so we test it for the first plant. And that is e can run the plant back down and stay at the stable power and come back up a few hours later. The plant automation is capable of doing that. But I'm not discuss that anymore because it really doesn't have any safety related implications.

CONSULTANT WILLIS: The OPRM thing? Is it going to be just a sort of a static situation or are you going to look at rapid transients and --

MR. DAHLGREN: We're going to look at rapid transients.

CONSULTANT WILLIS: You're going to look at rapid transients?

MR. DAHLGREN: Yes. Yes. For the last one, yes. That one, that test actually for the first unit RPS has an input from the OPRMs to trip the fans for the first operating cycle. Actually, I have a separate slide on it so let me wait and discuss.

Anyway, let me go on.

Now nuclear heatup. I've already discussed this. But basically we're going to run the heatup in nonnuclear mold with aux boiler and reactor water cleanup. And we're going to measure, basically we have temporary temperature indications on the outside of the reactor vessel and strings going down to make sure that we have a uniform heatup of the reactor vessel and the fluid in the reactor vessel.

CHAIRMAN CORRADINI: Can you just go back one thing? Maybe you're going to get to this later. But on the isolation condenser there was a discussion --

MR. DAHLGREN: Yes.

CHAIRMAN CORRADINI: And I'm going to ask staff this. But there was a discussion between an RAI that was essentially resolved about at what power you were going to test. This is the first of a kind test or is this the continued test for the isolation --

MR. DAHLGREN: This is just a first of a kind test.

CHAIRMAN CORRADINI: First of a kind test.

MR. DAHLGREN: Which will be just a validation of the fabrication test. Tests done at the fabrication site.

CHAIRMAN CORRADINI: Okay.

MR. DAHLGREN: But with the isolation

condenser in the isolation condenser pool. We're going to basically take both temperatures and validate our assumptions on makeup through the ICS pool after an accident condition and also measuring other issues like vibrations in the reactor vessel and so forth with isolation condenser in service.

CHAIRMAN CORRADINI: And this is that intermediate pressure zone?

MR. DAHLGREN: Not intermediate pressure. It'll be done -- yes, we'll not do this test at full power because of the cold water that we can inject from the --

CHAIRMAN CORRADINI: So the 50 to 75 percent range?

MR. DAHLGREN: It may even be 25 percent. We haven't decided yet. Because the pressure driving force is the same.

CHAIRMAN CORRADINI: And the reason for not doing a full power?

MR. DAHLGREN: We get cold water in return, and that's positive reactivity. And we don't want to do it at 100 percent power basically because of that.

CHAIRMAN CORRADINI: Because the return water will be too cold?

MR. DAHLGREN: It could be. It's inadvertent ICS initiation is an AOO an infrequent event, but there's no reason for this test to do it at a 100 percent power. There may be other reasons we picked that one for an AOO for stability reasons or something. But for this test it's not proposed to be done at full power. It's been done at enough pressure to get the driving force we want through the isolation condenser so we can just measure its performance.

CHAIRMAN CORRADINI: So that a minimum there would be 25 percent?

MR. DAHLGREN: Yes.

CHAIRMAN CORRADINI: Okay. Thank you.

MR. DAHLGREN: Okay. It's non-nuclear heatup. Basically just a comprehensive test of how the non-nuclear heatup that are assigned assumptions for the non-nuclear heatup works. That we have uniform temperature in the reactor vessel. We don't have anyplace where there is no heatup, for instance, or that region of the vessel would like heat up slower than other regions. So that's what we're trying to accomplish here.

And we continue that throughout the initial criticality evaluation. So it's two phases:

One preop phase and actually one startup phase on that one.

Core performance --

CHAIRMAN CORRADINI: Just remind us, the RWCU system where is that located? It's a pipe off the vessel, yes?

MR. DAHLGREN: Yes.

CHAIRMAN CORRADINI: But where is it? It's not a drain line?

MR. DAHLGREN: No, it's not a drain line. So that's the issue here because we don't have natural circulation through the core yet.

CHAIRMAN CORRADINI: Yes. And you have a chance of settling cold water where you don't want it.

MR. DAHLGREN: Yes. Right.

CHAIRMAN CORRADINI: So where is the takeoff for this then in the vessel? That's what I didn't remember.

MR. DAHLGREN: It's a line, it's right above the core. Right, Rick, isn't it, or is below?

MR. WACHOWIAK: It's right around the mid point of the vessel is where the reactor water cleanup shutdown cooling suction is. There are also four smaller lines that are at the bottom head that's used to prevent stratification and I guess to remove crude from the vessel. Those are small lines.

CHAIRMAN CORRADINI: Right. But that's not what I just asked.

MR. WACHOWIAK: That's not what he's talking about here. He's talking about the main suction lines which are about mid vessel.

MR. DAHLGREN: So this is why it's a focus for us.

MEMBER BROWN: That system, though, then has to be used every time you do a cold heatup?

MR. DAHLGREN: No. From then on, only for the initial startup. Because once we get -- we'll have decay heat the next startup.

MEMBER BROWN: So you're hoping there'll be enough.

MR. DAHLGREN: Oh, there will be.

MEMBER BROWN: Not shutdown?

MR. DAHLGREN: Yes, you're right.

MEMBER BROWN: I know how that works.

MR. DAHLGREN: Yes. I mean even if we have to wait there will be decay heat and we'll heat up the reactor vessel. This can augment it, but definitely the decay heat will heat it up.

MEMBER BROWN: Okay. But there was some

time of shutdown which your decay heat at the lower point will do it?

MR. DAHLGREN: Yes.

MEMBER BROWN: So that's the possibility that you'd have to do it again?

MR. DAHLGREN: Right.

MEMBER BROWN: So other than that, it's just a --

MR. DAHLGREN: For a protracted shutdown for some reason.

MEMBER BROWN: Okay. Thank you.

MR. DAHLGREN: Core performance first of a kind testing. This is for stability reasons. Basically to characterize the stability performance during power ascension and steady state also. And we'll basically do this at five percent power increments from 20 percent power and up. We'll collect the local power range power data to identify stability performance characteristics and determine the k-ratio during ascensions, which is like inserting a signal or a perturbation. And we'll basically --

CONSULTANT WILLIS: So you have put in a perturbation. You have to put in a perturbation.

MR. DAHLGREN: We will just by the fact

that we're going to raise power. Yes. Yes. And we have more slides on this.

And we also have oscillatory power range monitors. But for the first cycle for the first plant only the OPRM function will be installed to provide alarm functions only. Basically for the first entire cycle of the first ESBWR we will monitor and not verify, but monitor the OPRM basally performance. But not to forget that we're still looking at the local power range monitors to make sure that we have our stability situation understood and under control. But the OPRM eventually will not only provide alarm function, it will also provide a trick function to the reactor protection system. But what we want to do is try to verify and validate our basically and also to prevent spurious trips since we don't really have much operating experience with ESBWR for this algorithm. And the algorithm has really interesting-- hold on a second.

It's detect and suppress stability confirmation density is what DSSCD stands for. And it's offered to the current fleet as well. So there are several plants that have installed. And we have made small changes to it for the ESBWR.

In addition to this we're also working

with the Swedish utility Vattenfall that runs the Forcemark plants. And they also have a very well tested stability algorithm that they've used for their plants. And we have a technology transfer in place for that right now to try to adapt that to the ESBWR as well.

And really what we're trying to do is, I mean we have a design requirement either you're stable or you can detect and suppress stability issues or issues of instability. So we want to make sure we can detect and suppress those situations.

This a test feedwater temperature operating domain. I'm sure you may have seen various or one version or another of this operating domain. But this is where we anticipate that our operating through a cycle will require us to basically maneuver feedwater temperature in order to raise or lower power if rods for some reason or another is not our preferred choice.

And before we put this feedwater temperature operating domain into place we're going to test it quite extensively to make sure that our design assumptions and design results are verified. So we will have a feedwater temperature operating demand at the main map. Have you guys seen that?

Do you guys know what I'm talking about?

CHAIRMAN CORRADINI: Yes.

MEMBER ARMIJO: What is the temperature range that you're thinking about for the feedwater--

MR. DAHLGREN: Hold on. I'll show it to you. Because I have actually that in a slide. Don't look at the other slides back here.

MEMBER ARMIJO: That's interesting.

MR. DAHLGREN: This is very new. It's just been submitted to the NRC like a week ago. It's a little different from what you have seen.

CONSULTANT WILLIS: It's what we've been waiting for, isn't it? Yes.

MR. DAHLGREN: You've seen a dotted line on the bottom. Horizontal and to the right you've seen a dotted line here. And we've actually specified the lines.

And what we're looking at is SB-0 would be our normal 100 percent power rate position. It's a 100 percent 420 degrees Fahrenheit. And we propose that we can lower temperature down to roughly 370 Fahrenheit, the full power, or we can raise temperature up to 486 degrees Fahrenheit but then we're limited to 85 percent power.

So, of course, the testing would have to test these features.

Also surrounding this are protections in terms of trips. If the feedwater temperature goes out here, well we no longer meet our analysis assumption so therefore we're going to trip the plant. If we go higher than 115 percent power, we no longer meet our analysis assumptions and of course we're probably not meeting our tech specs for rated thermal power so we'll trip. So there are a lot of trips also that are overlaid on this curve. If you go too far to the left, you may not be stable so you will trip.

And this is available after about 50 percent power. But this is not something that we will do routinely. This will be done in order to maybe -- if we have a rod pattern issue or other limitations, we would do this. This is not something that we propose that the utilities use to get a better conversion rate, for instance, in the top of the core which you could imagine that we could do. But that's not the intended purpose of this operating the main ascension.

MEMBER SIEBER: So the only purpose of it is to get around conflicting core runs?

MR. DAHLGREN: Yes.

MEMBER SIEBER: Okay. Does that occur in today's BWRs?

MR. DAHLGREN: Well, we do it with flow. That's the thing. We needed something else than just rods to move the plant, and so temperature was it.

MEMBER ARMIJO: Recirc pumps.

MEMBER SIEBER: So you don't operate the governor valves on a turbine?

MR. DAHLGREN: We could do that, too. And this allows that, too.

MEMBER SIEBER: It's the formal way to do it, right?

MR. DAHLGREN: Well, yes, I guess you could, yes. Right. Yes, we're right. Yes, we could back off from the limit basically is what you're saying. Yes, that's always a choice.

MEMBER SIEBER: That how do your core anomalies.

MR. DAHLGREN: Yes. Yes.

MEMBER SIEBER: So this is just a convenience for somebody that wants to do something different.

MR. DAHLGREN: It's a convenience for a few conditioning and rod pattern swaps and so forth.

Yes.

MEMBER SIEBER: And who in the plant staff would decide to do this? Not the operators, right?

MR. DAHLGREN: I would imagine reactor engineering with some help from us.

MEMBER SIEBER: Yes.

MEMBER ARMIJO: So you're going to demonstrate this capability. But as far as actual operation of the plant the power flow map is really just a aligned?

MR. DAHLGREN: Yes.

MEMBER ARMIJO: Okay.

MR. DAHLGREN: Yes.

MEMBER SIEBER: Thanks.

MR. DAHLGREN: I mean this available -- yes. Anyway, anymore questions?

MS. CUBBAGE: Well, I don't want to leave you with the understanding that this not going to be used. They fully intend to use this, they just don't intend to use it daily.

MR. DAHLGREN: Or routinely.

MS. CUBBAGE: This is when they want to do their rod swaps. Because they can't maneuver with--

MEMBER ARMIJO: But it isn't going to be used routinely, let's say, for economic benefit which you might be able to extract from this?

MS. CUBBAGE: We would be --

MR. DAHLGREN: We don't recommend that.

MS. CUBBAGE: -- but that the certification allows operation in these off points.

MEMBER ARMIJO: Within that field?

MS. CUBBAGE: Yes. The certification if approved would allow them to do that whenever they chose to. What they're saying is they only anticipate using it when they need it to do maneuvering for rod swaps, et cetera, or for end of cycle coastdowns, perhaps.

MEMBER ARMIJO: Somebody going to figure out how to make money off that --

MEMBER SIEBER: It's a bigger ballfield and harder to get to.

MS. CUBBAGE: Well, I don't see anywhere they're getting above 100 percent on this. So I think, you know, when they're going down in power and they're --

MEMBER ARMIJO: Less than 100 percent is going to --

MS. CUBBAGE: Yes, and they're taking an

efficiency hit I think to do it, right? It's not a benefit.

CHAIRMAN CORRADINI: Go ahead. You can go back to your --

MR. DAHLGREN: All right. Thank you.

We were there, right??

CHAIRMAN CORRADINI: Just a time check, you're going to be done in 20 minutes, right?

MR. DAHLGREN: I can be. Depends. I can go faster the last slide.

I talked about this one already. This is isolation condenser system test. We're going to look for vibrations, steam inlet and condensation return flow, change in pool bulk temperature, pool level change.

We're going to have test one of these a system performance test for one of these each cycle per our tech specs. So this test this is the first time we're going to test isolation condenser and we're going to get quite an exhaustive amount of data. We're also going to know how the plant reacted when we put this in service. That way we can derive test acceptance criteria for our following tests not using this complicated method, but maybe using a method -- this is what I hope that we can do. We have the reactor putting out 25 percent power, let's say. We have the turbine set at 25 percent rate of thermal rate. And we can dial down the turbine a little bit and get the turbine bypass valve to open up. So now we sit there.

Then we start, we put this in service. And that takes part of the steam that the turbine bypass valve wanted to see, and that goes back closed. How much does it go back closed and do we know how much it removed based on how much it took.

So the purpose of this test is just basically to get a good set of data for the isolation condenser system. We know it removed the heat that it's supposed to remove, 33.75 megawatts thermal per units times four. We'll do this on one unit and then the other ones we can test using the turbine bypass valve. And we know that we have a good result.

That's my hope. I'm not sure yet that we're going to get that of a simple test criteria, but I'm really hopefully that we can do that.

And then we have other unique features tested. However, they're not first of a kind tests. They will be performed for each unit.

MEMBER STETKAR: Can I just ask you, I

hate to do this but not really.

MEMBER BROWN: No you don't.

MEMBER SIEBER: No, I don't. I kind of like this.

I did read through all of the test stuff. And how much have you thought about for example the ICS test if I read what it says, it says you're going to initiate it by opening up the normal condensate return valve and the bypass valve. Now if I really wanted to test the system, I would open those separately because each of those are supposed to be full flow test valves.

MR. DAHLGREN: Meaning turbine bypass valve?

MEMBER STETKAR: Oh, no, no, no, no. The ICS gravity --

MR. DAHLGREN: Okay. That one.

MEMBER STETKAR: The ICS condensate return valves. The description of the test says you're going to test it up by opening up both of them. Why both, why not individually? It would seem individually would test the features better. Because the bypass valve is the backup to the normal valve. Any reason why it's both of them? Did anybody think about why you should open them individually rather than altogether?

MR. DAHLGREN: I don't have an answer to that question.

MEMBER STETKAR: Okay. I'd like an answer to that.

MR. DAHLGREN: Okay.

MEMBER STETKAR: Thanks.

MR. DAHLGREN: Yes. The only answer I can think of is that we're testing the heat exchanger itself.

MEMBER STETKAR: That's right. But you'd like to test the fact that it would remove heat during --

MR. DAHLGREN: With restricted -- so what's going on the condensate return tank is full of water, so I don't think it's going to be a difference.

MEMBER STETKAR: No, I understand how it works. It's just a matter there's two valves in parallel, one of which is supposed to be the backup for the normal one.

MR. DAHLGREN: That's why I think -- if I remember correctly, they're both going to open on the same signal as well. Anyway, I'll look into it.

MEMBER STETKAR: There are known

conditions where only one of them will open.

MR. DAHLGREN: That's a good point. I'll look into that.

MR. DAHLGREN: GDCS preop test. This is where Dr. Wallis had questions, and you may still have questions when I'm done with this.

We will basically verify -- obviously, this is just almost like a construction test. Just to make sure that there's nothing -- well, these are tanks and people wear things and carry things --

CONSULTANT WILLIS: You've got the right pressure and there's nothing in the core or anything and you see the water flows through the pipe?

MR. DAHLGREN: Right. But first, of course, we also make sure that everything is -- that's basically right.

CONSULTANT WILLIS: So all the questions that we asked about containment function are not tested in this test?

MR. DAHLGREN: Containment function?

CONSULTANT WILLIS: We have all kinds of questions about transients and mixing and there's flushing and temperature ---

MEMBER SIEBER: As in preview analysis.

CONSULTANT WILLIS: That's all analysis.

You can do it, no? So it's a very, very simple --

MR. DAHLGREN: Yes, it's just a simple--

CONSULTANT WILLIS: -- to see if somebody left something in the pipe.

MR. DAHLGREN: It's like a bucket with a straw is how I like to --

MEMBER SIEBER: The test doesn't do what you thought --

MEMBER STETKAR: The test valves you're going to install to do that, it says you're going to use previously actuated or something squib valves. Are you actually going to open a valve actively or are you just --

MR. DAHLGREN: Yes, we're going to use test valves.

MEMBER STETKAR: -- going to crank open an isolation valve and activate it?

MR. DAHLGREN: We're going to install test valves that will test the firing logic the squib valve. But it will just open the valve instead of firing off the propellant?

MEMBER STETKAR: Like an air operated or cylinder valve or something like that?

MR. DAHLGREN: Yes.

MEMBER STETKAR: Okay. Thanks.

MEMBER BROWN: If I understand that right for the squib valves, I want to just summarize in my ignorance.

MR. DAHLGREN: Okay.

MEMBER BROWN: The whole preposition, the whole setup for accepting that is you're going to use process control to verify the quality of the explosive to blow the thing open and then have periodic tests or whatever tests you run in where you test the logic and that you get something to fire, whatever it is, a spark or a hot wire or whatever it is?

MR. DAHLGREN: Yes.

MEMBER BROWN: And then you test that that actually gets -- is it a hot wire or something? What is it that makes the explosive explode?

MR. DAHLGREN: It's a hot wire, yes. It's a little ceramic nod with a wire.

MEMBER BROWN: Do you test that to see that it gets hot?

MR. DAHLGREN: We test it to make sure - we can pull the thing out of the valve and test it, fire it.

MEMBER BROWN: It's an arc, or it just a--

MR. DAHLGREN: I believe it's an arc, yes.

CONSULTANT WILLIS: Now does the pipe full of water or air when you open the valve?

MEMBER BROWN: Now before you get there isn't map summary correct and that's how this thing is accepted?

MR. HONMA: I believe also during operation those valves are placed periodically and that they are actually fired. If we find that it doesn't operate, then there's a reportable condition, I believe, that gets reported.

MEMBER BROWN: This is similar to though what is now occurrence -- valve?

MR. HONMA: Yes, sir.

MEMBER BROWN: Yes.

MR. HONMA: And that's required by the tech specs.

MEMBER BROWN: So you put in another set of squib valves where you're depending on the process control --

MEMBER SHACK: No, no. The charge.

MEMBER BROWN: Pardon?

MEMBER SHACK: Charge.

MEMBER BROWN: Well, another charge.

Okay. That's fine then. Okay.

MEMBER SHACK: But again if you get a charge that doesn't go off, I suspect you're going to have an --

MR. HONMA: Have an issue.

MEMBER SHACK: -- long discussion.

MR. HONMA: Yes.

MEMBER BROWN: Well does that mean that you have to keep records then of the particular batch of each explosive --

MR. HONMA: Yes. Yes.

MEMBER BROWN: -- and which one is in each one of the squib valves? Is it labeled or is it--

MR. HONMA: Under the quality assurance program we keep records.

MEMBER BROWN: Yes, I understand that. But is it on the little explosive device that's in the valve, is there a stamp that says what batch, what year it was made, et cetera, et cetera, all that?

MR. HONMA: They're all uniquely identified. I'm not sure that's on there or if it's in the program.

MEMBER BROWN: Well, why wouldn't it

have to be on the specific device itself?

MR. HONMA: I just don't know. It could very well be.

MEMBER BROWN: Somehow you got to be able to identify that to that device.

MR. HONMA: Yes.

MEMBER STETKAR: Bar coding.

MEMBER BROWN: Yes, some marking.

MR. HONMA: Yes. And basically if that doesn't fire, we replace everything out of that batch in the whole plant.

MEMBER BROWN: Yes, I understand.

MR. HONMA: So there is a logic to it.

MEMBER BROWN: I didn't say I agree with it. I just said I understand what you're doing.

MR. DAHLGREN: Yes.

CONSULTANT WILLIS: So the technical question being asked is is there a blockage in the pipe which is the flow rate consistent with what you predict, is that correct?

MR. DAHLGREN: Yes.

CONSULTANT WILLIS: And I was going to ask what's in the pipe when you start? Is it full of air or full of water? If it's full of air, you don't have any head to start it and something has to happen to get it going. Are you going to do that test or is that irrelevant?

MR. DAHLGREN: Oh, you're looking at in case we have like a gas accumulation in the pipe or something like that?

CONSULTANT WILLIS: Right.

MR. DAHLGREN: I can't answer. I don't know if we're going to test that or not. We would certainly be able to test it.

CONSULTANT WILLIS: But you haven't said what questions you're asking. I don't know what you're testing.

CHAIRMAN CORRADINI: But just to get to the original question he's asking, is the test run with the assumption or with the precondition you wanted full of water or --

MR. DAHLGREN: That's what I assumed. I have not thought about this issue before. I've not heard of it. But you're right. I mean I know in operating plants we have gas accumulation from various sources.

CONSULTANT WILLIS: Well, you have to specify something about that.

MR. DAHLGREN: To our advantage -- well, I can't say anything about that.

There could be gas intrusion in this system, too, but there are ways to detect that and prevent it. I have not part of those discussions before so I was assuming that we tested this with it full of water or we repeat it.

CONSULTANT WILLIS: Now just this procedure, what goes to the COL applicant? Does it specify all these details about the test?

MR. DAHLGREN: Correct.

CONSULTANT WILLIS: It seems to me surprising since it's your design that you don't want to be sure that it works.

MR. DAHLGREN: We'll definitely be part of it. Oh, we'll be part of it. Of course we will.

MEMBER SIEBER: Well, that's all they're testing, though, is to make sure it works not that the analysis behind it is good.

CONSULTANT WILLIS: That's part of the purpose of the test, isn't it?

MEMBER SIEBER: No.

CONSULTANT WILLIS: It says so here, though. The validation of the analytical models and assumptions. This is part of the purpose of the whole thing.

MR. DAHLGREN: But we discussed this

before until we get an answer, we get a flow rate out of this test. And we should --

MEMBER SIEBER: Under the right conditions you aren't going to get any.

MR. DAHLGREN: We could derive or scale it to the conditions of where we would assume the GDCS would start in an accident. There's no way for us to test it in accident conditions. And that's the same way you do in the currently operating plants as well where you do, for instance, high pressure suction--

CONSULTANT WILLIS: But I would look for some sort of rationale which says in accidents these various things happen and these are some of the technical questions we have about whether or not it will happen as designed.

MR. DAHLGREN: Right.

CONSULTANT WILLIS: And we do tests to verify those things. And you sort of say, yes, we can do this test and that test and this test and these are the things we'll look for. We can't do those tests because it's just impractical.

Is there some sort of rationale like this somewhere one can look at and see why you chose to do this test of this system and not other tests of this system?

MS. CUBBAGE: Graham, we also need to be careful we're not getting into the realm of what tests should be done before we certify the design. There's the test program that supports of certification that provides all the validation for the thermal hydraulic codes. There are specific requirements for new plants that new features be tested. So, you know, they did conduct a test program on the test facilities, PANDA, PANTHERS, et cetera, et cetera.

So this isn't intended to be that type of test. This is to confirm that it's been built as designed.

MEMBER SIEBER: Right.

CHAIRMAN CORRADINI: And then they're going to scale the flow to a sum analysis to make sure that it's consistent, is that how I understand your description?

MR. DAHLGREN: The ITAAC talks then, and Rick can jump in here if I'm completely out of line, but it talks probably about a test report or something that will show our test data versus our design assumptions and make sure that they meet. That what we got is what we hoped to get. More, hopefully, than we might hope to get.

MS. CUBBAGE: But this is truly in the verification mode where at the certification stage we have to have enough test data and information so that we have reasonable assurance that the design will perform.

CONSULTANT WILLIS: So I presume that there's some kind of criteria which says the lost coefficient for this pipe has to be a k of 271 plus or minus 15 and if it's outside this range, you'd better check why it's not?

MR. DAHLGREN: Yes, that would be in ITAAC.

CONSULTANT WILLIS: Isn't that the kind of thing you have?

MR. DAHLGREN: I'm not familiar with ITAAC for this system, but that would be the kind of thing that ITAAC would do.

MEMBER SHACK: The injection lines provides sufficient --

MS. CUBBAGE: We have a RAI on that, as a matter of fact.

MEMBER SHACK: -- flow to maintain water coverage above top of active fuel for 72 hours during the design basis LOCA. That's the commitment.

Now as Rick says, exactly how you do that with a test under air atmosphere and such--

CONSULTANT WILLIS: Then I don't know.

MEMBER SHACK: Well, you're going to get some measurements and then you're going to have to go through an analysis to show that it is in fact consistently with that.

MEMBER SIEBER: To scale, yes.

MEMBER SHACK: But as Amy says, I mean you did the GDCS test somewhere else. I mean, you know the PCCS test, the ICS test have all been tested--

MEMBER SIEBER: In a lab someplace.

MEMBER SHACK: Yes.

CONSULTANT WILLIS: I don't know about the GDCS, but essentially the PCCS test.

MS. CUBBAGE: Yes.

MEMBER BROWN: At one of those earlier meetings I didn't hear anything about they were going to build a mockup of the PCCS or the GDCS.

MR. DAHLGREN: Oh, they have. It's been done years ago.

MS. CUBBAGE: Yes, it's been done. It's all done. It was done in the '90s.

MR. DAHLGREN: And they'll also have fabrication testing as well.

MEMBER SIEBER: No one builds a plant if you didn't know it's --

MR. DAHLGREN: I don't know if I answered your concerns, Dr. Wallis, but that's it. But this is PCCS test, passive containment cooling system. And I wanted to show you what we do. We try to piece everything together to improve the design. Okay.

So for the GDCS test we pieced together a flow test. Our test facility and our valve testing, they're all separate pieces. And for the PCCS test it's the same thing.

We don't propose a test even though we're interested to do a test like this. But we don't. We could fill the whole drywell up with steam and see that it actually functions, but it's impractical. Yes. We can't.

CONSULTANT WILLIS: So I'm not quite sure what you're going to do then.

MR. DAHLGREN: So we'll base it on the test facility, tests that were done. We'll base on fabrication testing that we will do with noncondensibles with a controlled environment where we know what we're putting into the heat exchanger and taking out of the heat exchanger, which we could not have done in the ESBWR design. And then we have verify that what we have installed validates.

CONSULTANT WILLIS: That's not really a test of function?

MR. DAHLGREN: No.

CONSULTANT WILLIS: It's not a test of function. It's a test that it's built as designed and that the various functions have been checked somewhere else. It's not as designed. It's misleading in a way to read this guide which says you've got to check that it's functionality and all that. You don't check the functionality. You don't test the functionality. You don't verify the functional requirements directly by a test. You do it by referring to other tests.

MR. DAHLGREN: And ITAAC inspection tests, analysis, acceptance criteria. So you can meet an ITAAC by a combination of inspection tests and analysis criteria, which is some type of summary report. I want to point that out because even though like I said as a startup testing engineer it would probably be the interesting test to run but I don't know what we could measure and how we could control the environments and if it would even be a valuable test at the very end after all that expense.

CONSULTANT WILLIS: When somebody like me reads this document, though, it almost looks as if you're going to actually test that it functions as needed --

MR. DAHLGREN: Yes. Right.

CONSULTANT WILLIS: -- in an accident. And there's no way you can do that?

MR. DAHLGREN: No. Not for the passive system, it's very difficult.

Okay. I have five more slides, so that's a good ratio.

Oh, major transient tests. I'm going to have to go fast. But we've already talked about a few of these.

I just want to point out that we are going to do a loss of load/turbine trip test. We're going to test that we can shutdown and cool down the plant from outside of the control room.

We're going to close all the MSIVs and make sure that the plant responds like we thought.

And we're also going to do a lot of feedwater pump testing where we trip off feedwater pumps or introduce an instability in the feedwater system to see how the core and plant systems in general, integrated plant systems respond.

MEMBER STETKAR: I'm going to stop you there for a second. The third bullet loss of turbine generator offsite power test, and I'm not familiar enough with the regulatory requirements so, Amy, shoot me down quick if I need to get shot down. That's a rather aggressive test. You're actually going to trip the plant from full load --

MR. DAHLGREN: No.

MEMBER STETKAR: And then shut off all offsite? That's the way it's written. It says from full load and shutoff all offsite power for 30 minutes. Has anybody evaluated the risk of actually performing that test and is it required by the regulations? I mean, I read that and I said "Gee, this is -- you're not willing to blow a squib valve but you're willing to throw the plant through a pretty reasonable transient."

MR. DAHLGREN: It is, I agree.

MEMBER STETKAR: Why are you doing that?

MR. DAHLGREN: The only answer I can tell you is the only reason we would do it is because it would be in the reg. guide.

MEMBER STETKAR: Well I guess what I'm asking if it's required by the regulations, it's not clear that it's prudent.

MEMBER SIEBER: I don't recall that.

MEMBER STETKAR: But I don't recall it being required. So I was curious to see that it's there because it's something --

MEMBER SIEBER: It's a pretty healthy--

MEMBER STETKAR: -- being so cautious is not doing a full functional test of the GDCS1; in other words blowing it down from temperature and pressure to see whether you get injection.

MR. DAHLGREN: The reason to that is that --

MEMBER STETKAR: But doing this?

MR. DAHLGREN: The reason there is that we don't know for GDCS -- and I agree with you by the way. But the GDCS system it's very difficult to get the conditions for it set up in the first place.

MEMBER STETKAR: Well, I was going to ask you about this and since we're going to over time anyway I'll --

CHAIRMAN CORRADINI: Briefly over time.

MEMBER STETKAR: Okay. But I'm going to ask him a couple of other things. You could indeed do--

CHAIRMAN CORRADINI: Can we just store the first one that somebody's going to come back to you about answering the connection back to staff?

MEMBER STETKAR: Sure.

MR. DAHLGREN: You mean on the loss of--

MS. CUBBAGE: Right.

MEMBER STETKAR: Yes. I'd like an answer about why they're doing that.

The other thing, GDCS indeed you could heat it up and pressurize it, blow down through the ADS to the wetwell. You don't have to blow --

MR. DAHLGREN: Not in the preop stage, though.

MEMBER STETKAR: Not in the preop stage. This would be in ITAAC. This would be in ITAAC.

MR. DAHLGREN: Right. It wouldn't be in ITAAC because we don't have steam. I don't see how we could that. It's not in preop because we don't have fuel in the core.

MEMBER STETKAR: Well, but it would be a lower power test then?

MR. DAHLGREN: Right. And that's when we're going to violate tech specs if we do that test.

MS. CUBBAGE: If you get power, you can't do ITAAC.

MR. DAHLGREN: So when you have fuel in the core --

MEMBER STETKAR: He's probably right.

MR. DAHLGREN: -- you can't line up your systems that way because you're going to violate tech specs. It's not safe. And one thing other that this is not --

MEMBER STETKAR: It's not clear that shutting off all offsite power is safe.

MR. DAHLGREN: I agree. I agree with you, and it's not in our tech specs to have offsite power. However, it is --

MEMBER BROWN: Do you have to shutdown if you lose offsite power?

MR. DAHLGREN: We can stay in island mode.

MEMBER BROWN: You can or can't?

MR. DAHLGREN: Yes, we can.

MEMBER BROWN: Then you could continue to operate, in which case that scenario would apply? They would have all power off -- you just said they could operate. And therefore then if they have the turbine generator trip, that's a real transient with which you have to deal.

MR. DAHLGREN: In a turbine trip and a loss of load trip, the design is --

MEMBER BROWN: It's a perfectly rational transient --

MR. DAHLGREN: The loss of load and turbine trip for an ESBWR will result in selected rod insertion and our goal is to end up at about 60 percent power and be able to stabilize there. Now we're going to have sort of a rod configuration that's less than desirable. So that will have to be dealt with following the event, but we'll definitely stay on line after turbine trip or a loss of load.

Our turbine bypass valve capability is a 100 percent. And the really limiting factor there is the condenser sizing, which we're not done yet. We haven't completed those analyses.

Anyway, in the interest of time I'm going to move on.

The last three slides are just more program descriptions on procedures, what we're going to have in the procedures and I've talked about that, so I'm going to skip it.

CONSULTANT WILLIS: Does it say anything at anytime about the suppression pool bypass leakage tests? Is that going to be this afternoon or something?

MR. DAHLGREN: No. It's a preop test. It's basically for the vacuum breakers you're talking about?

CONSULTANT WILLIS: Right.

MR. DAHLGREN: Yes. It's a preop test.

CONSULTANT WILLIS: But it's going to be nothing like under real accident conditions?

MR. DAHLGREN: We bring in a test rig for that. I'm not -- I've not gotten there yet in my knowledge how we're going to actually do it. I know we bring in a vendor with a specific method for those.

CONSULTANT WILLIS: Otherwise a drywell with air or something and see how much leaks and --

MEMBER STETKAR: It's actually a description and I think a pretty decent description of what -- I mean not that detailed, but what they're going to do.

CONSULTANT WILLIS: Not that much detail about it.

MR. DAHLGREN: Anyway, back to basically I've just listed what the procedures. RG 1.68 rev.3 has fairly specific guidance on what procedures should include with signature blocks, hold points, things like that. That's nothing unusual.

And then, of course, we've implemented our lessons learned here. It's an evolutionary design and it's based on the ABWR and other BWR test programs.

I've included the NRC licensee event reports, INPO, operating experience and other plant operating experience within the GE fleet.

CONSULTANT WILLIS: And all these test procedures are not in this document here?

MR. DAHLGREN: No, we're not. It's not nearly completed yet.

CONSULTANT WILLIS: Quite often the devil is in the details.

MR. DAHLGREN: Absolutely.

CONSULTANT WILLIS: Which we don't see here. A very high level view we have here.

MR. DAHLGREN: Yes, it is. The devil is in the detail, yeah.

And this is what the COL applicants and holders are supposed to provide to the staff:

A description of the initial testing program. It's already been provided, I believe to the COLA. It's Appendix 14 alfa alfa to the COLA.

And then for the holder they have to provide a startup admin manual, the actual manual.

Test procedures are to be provided by the holder.

Test program schedule and sequence by the holder.

Site specific tests. Yes, we haven't talked about that, but this is only for the scope of GE that I've talked about today. Of course there are going to be other site specific tests for the yard for the ultimate -- we call it service water intake things like that, things of that nature.

And then both the list of the tests that have to be performed by the applicant and the procedures for those tests are to be supplied by the holder and the summary.

Any other questions?

MEMBER STETKAR: In the interest of time I'll hold off on two or three others I had.

CHAIRMAN CORRADINI: So you get one.

MEMBER STETKAR: I get one. Thanks.

In the scope of the testing program there are tests for the ventilation systems. And the test for the ventilation systems as I read them are pretty standard tests. You make sure that the ventilation systems keep the rooms cool and all that kind of thing. That's good.

The design of the plant says that it needs to operate for 72 hours with no ventilation. But I didn't see any tests to confirm that indeed it would operate for 72 hours with no ventilation. Why?

MR. DAHLGREN: That's a good question. I think we're still trying to figure out how we're going to test ventilation systems.

MEMBER STETKAR: Well, no. It's not testing the ventilation. It's showing off all the ventilation --

MR. DAHLGREN: Well testing equipment tests. Yes.

MEMBER STETKAR: Making sure you have the heat loads into place, putting in thermal couples and making sure the temperature is --

MR. DAHLGREN: Good for 72 hours.

MEMBER STETKAR: -- good for 72 hours on a hot summer day if you want to do it on a hot summer day.

MR. DAHLGREN: Well, we got to do that--

MEMBER STETKAR: There's probably enough concrete it doesn't make any difference.

MEMBER SIEBER: You do it in the winter.

MEMBER BLEY: With the doors open.

MEMBER STETKAR: My point is is lining the testing program to test the functionality of safety system performance, it seems to me the functionality of safety system performance with respect to ventilation fort his plant design is, indeed, to remain functional for 72 hours with no ventilation. And I didn't see any tests that do that.

MS. CUBBAGE: I missed the beginning of your question. Are you speaking of the passive cooling for the control room --

MEMBER STETKAR: Not just for the control room. It's for all areas that retain safety related equipment. So there are areas of the control room, control building outside of the control room, there's areas of the reactor building, the clean areas of the reactor building that has all of the safety related inverters and --

MS. CUBBAGE: I'll use the control room itself as an example. We do have an RAI with GE. We're looking for them to verify through ITAAC certain system structures and components that are essential for the passive cooling.

MEMBER STETKAR: Okay. I might have

missed that one. But my concern is broader than just the control room.

MS. CUBBAGE: I understand, yes.

MEMBER STETKAR: It's just the control building and the reactor building in particular.

CHAIRMAN CORRADINI: But you're looking for some verification that functional testing has been done to show that they can sit there and operate.

MEMBER STETKAR: The temperatures and humidities remain below design criteria --

MEMBER SHACK: But there is an ITAAC that seems to do that.

MEMBER STETKAR: Where?

MS. CUBBAGE: There's EQ in --

MEMBER SHACK: 216-13 commitment 7.

MEMBER STETKAR: Okay. In the interest of time, I'll look at it.

MEMBER SHACK: I mean it's not saying exactly how they're going to do that, but there is at least some recognition that you have to demonstrate this 72 hour cooling capability.

MR. DAHLGREN: Other questions?

CONSULTANT WILLIS: On the leakage and the --

MEMBER SHACK: Well, that 72 hours says -- as I said, the details of exactly how that test is going to be done aren't here, but the commitment is sort of recognized and we leave it to the poor COL guy to --

MR. DAHLGREN: Or to me. I mean we'll be heavily involved in the procedures, writing all these procedures. And I know there's kind of a -- everyone says this is going to be so huge. This is so much to test. But I mean we're just going to work it off item-by-item and get it done. That's what you have to do.

But that one in particular I mean you can certainly imagine doing a heat up test with ventilation off and verifying the design. But if it's not in 14.2, it should be and it is in the ITAACs.

CONSULTANT WILLIS: Does this ESBWR have fans in the line from the PCCS to the wetwell?

MR. DAHLGREN: Yes, but only it has fans, but we don't use the fans until 72 hours.

CHAIRMAN CORRADINI: They're not required to use the fans.

MR. DAHLGREN: Yes.

CONSULTANT WILLIS: Oh, it could work up

to 72 hours without the fans?

MR. DAHLGREN: Right. Correct.

MEMBER SHACK: That's the passive plan?

CHAIRMAN CORRADINI: That's the long term cooling memo we're going to --

MR. DAHLGREN: But our preop test verifies that the fans will indeed start from the control room.

CONSULTANT WILLIS: And for a bigger leak you might need to start them earlier.

MR. DAHLGREN: We're not going to start them before 72 hours in our analysis. And I could probably start them at 30 seconds.

CONSULTANT WILLIS: That's right.

CHAIRMAN CORRADINI: Other questions?

Okay. At this point thank you very much. You're not going very far anyway because we ask you to clarify things when we talk to staff.

Let's take a 15 minute break.

(Whereupon, at 2:42 p.m. off the record until 3:01 p.m.)

CHAIRMAN CORRADINI: Well let's get started. Why don't we get started? The staff has a presentation to discuss Section 14.2. And John Nakoski will kick us off.

MR. NAKOSKI: Thank you. Appreciate the opportunity to come and brief the ACRS Subcommittee on the status of the staff's review of Section 14.2 of the ESBWR DCD application. You're aware this is a multiple year review involving a broad number of staff from multiple disciplines. The principle from my staff that's been involved in this review is Frank Talbot. I recognize his role has primarily been facilitating the technical reviews and ensuring the reviews that have been done by the other staff has been consistent with the guidance in RG 1.68 and the Standard Review Plan.

Also up here is Leslie Perkins, who is the licensing project manager for the ESBWR DCD. Is that correct? And with that, I'd like to turn it over to Frank.

MR. TALBOT: Okay. The purpose of this is to brief the ACRS Committee on the status of DCD Section 14.2 initial test programs. And describe the applicant's compliance with regulations, reg. guides and the Standard Review Plan. And then to summarize the status of resolution of RAIs and supplemental RAIs and combined license items.

Next side.

As John just iterated, Leslie is the

lead. I, Francis Talbot am the lead in the quality and vendor branch. And I act kind of like a mini-project manager working with many technical reviewers across the entire Office of NRO on RAIs that the staff wants to issue to the DC applicant on Section 14.2 initial test programs.

To date, we've had about 16 NRO technical reviewers provide a number of RAIs.

Next slide, please.

The initial test program requirements are listed here. I did not get all of them listed there. There are others like Part 50 Appendix B or Section 11 test control and Part 50 Appendix J. And then the RG 1.68 has 21 footnotes for a number of other reg. guides, a number of other regulations like ASME Section 3. And I just listed the reg. guides where we had concerns. Like on RG 1.20 we did have a RAI associated with that. And then RG 1.206 verification programs is used for -- and then NUREG 1402 Standard Review Plan is the other major guidance document that we use.

CONSULTANT WILLIS: Did you hear my questions this morning or earlier?

MR. TALBOT: Yes, I did hear all of them.

CONSULTANT WILLIS: Because this kind of thing is really baffling to the laymen. It's all this sort of thing. We're not going to go and look up all these guides.

MR. TALBOT: That's right. There's 21 of them in RG 1.68.

CONSULTANT WILLIS: And what are the technical questions and how are they answered?

MR. TALBOT: And that's what I'm driving to. Yes.

The status summary is we issued 98 RAIs. And of those 98 RAIs, GE resolved 93 of 98.

We had eight supplemental RAIs, too. And GE has resolved five out of eight of those supplemental RAIs. And the five that are shown up on the screen are the ones that GEH has not provided an answer to as yet.

The first thing I'll do is go through the COL items. We had initially asked the applicant through RAIs 14.2-16 through 21 and a supplemental RAI to provide COL information during the design certification application.

And the first one is a description of the initial test program administration. And the second one is the site specific tests. And then during the COL holder phase, the first two that have to be addressed during the applicant phase. And there's four other COL items and they have to be addressed during the holder phase to meet RG 1.206 and SRP 14.2

So the startup admin manual, that's provided to the NRC staff 60 days prior to intended use. And then the individual test procedures are also supposed to be provided 60 days prior to intended use.

MR. NAKOSKI: This is John Nakoski.

This answers the question that was asked earlier about 60 days prior to fuel load or intended use, whichever is sooner, whichever gives the NRC staff the most time to review it before --

MEMBER SHACK: Even 60 days, that's not a whole lot of time.

MR. NAKOSKI: It's impressive, it's impressive. Yes, it is.

MEMBER ARMIJO: But the NRC doesn't have to actually formally review and accept this, right? You just get it for information?

MR. TALBOT: Not during the applicant phase. During the holder phase it becomes kind of like an NRC inspection activity.

MR. NAKOSKI: That's correct. It is an NRC inspection activity that we: (1) for familiarity and make sure that it's consistent with our understanding of what's supposed to be tested.

MEMBER ARMIJO: Okay.

MR. TALBOT: The next slide, please.

Then there's the last two COL holder items, the test program schedule and the sequence. We ask for that information because as part of our inspection activity we need to plan for when we're going to go out and do those inspection activities. And so we want to see GEH's schedule, their roadmap for doing the preop tests.

And then the site specific tests are provided by the COL holder also, like ultimate heat sink, cooling tower would be examples.

MR. NAKOSKI: And it's important that we have the licensee's schedules. At that point they're a license. So that we can have our resources in place at the time to witness those tests.

MR. TALBOT: Next slide, please.

Okay. The first RAI that has not been resolved is on the system vibration test. And we asked GEH to provide expansion, vibration and dynamic effects testing to meet RG 1.20 and RG 1.68.

And 1.20, by the way, was updated in March of 2007 to put in a whole bunch of new additional information. It may be that since GEH reapplication came in before that particular system vibration system test could address it. Because that was a March 2007 reg. guide. So now GEH just needs to address in the test criteria the potential adverse flow effects on piping systems recommended in the RG 1.20 and also to meet SRP Sections 2.9.2 and 3.9.5. And GE has stated that they're not taking any exceptions to these reg. guides. However, in a supplemental RAI that we wrote -- next slide, please. Operating experience has revealed adverse flow effects from vibration due to hydrodynamic loads and acoustic resonance. And this effects the reactor coolant system, steam and feedwater systems and internal components like the feedwater drivers or steam drives.

And so system vibration tests for piping systems need to be discussed in Section 14.2.8.2.10 and it does not address these potential adverse flow effects. So the staff requested the applicant to describe these dynamic effects on safety related piping and components.

The next --

CONSULTANT WILLIS: They have not done that yet?

MR. TALBOT: They have not answered the RAI yet, the supplemental RAI.

CONSULTANT WILLIS: Do they intend to issue the steam separator first thing?

MR. TALBOT: Steam dryers? Yes, they do need to add information associated with adverse flow effects on -- there's also another RAI later on that's associated this issue, vibration and dynamics effects testing.

MEMBER STETKAR: So just so I understand when you said all this I kept on thinking, as Graham asked, the steam dryer. Are there other systems or components that would require this sort of vibration and dynamics testing?

MR. TALBOT: Well, we did mention the reactor coolant system, the feedwater and steam systems. I can check with the staff if there's other systems that also --

MEMBER STETKAR: But primarily the dryer was what the --

MR. NAKOSKI: That's the main internal reactor vessel internal component that I think has been identified as requiring additional analysis or demonstration based on operational experience to need some additional testing.

MEMBER STETKAR: The big chimney structure, that's not one that you're worried about?

MR. TALBOT: I think there's test that covers the chimney structure.

MS. CUBBAGE: Yes. We have a whole other review effort going on under Chapter 3 looking at ensuring they have adequate vibration monitoring and programs. It encompasses all of the internals, but there are specific operational concern. Of course you're aware of the dryer issue so that's why this was being highlighted.

MR. TALBOT: RG 1.20 lists a number of those components. The tuning may be on that list. I'll have to --

MS. CUBBAGE: Well, the chimney is specific to ESBWR. But they're applying that reg. guide to the BWR internals for ESBWR.

MEMBER SIEBER: Okay. Well I sort of doubt that there is a test that verifies that the chimneys will hydraulically work the way they were designed. All you're looking at is vibration and things like that as opposed to the characteristics of the flow in the chimney at various conditions including accident condition.

MR. NAKOSKI: I think primarily we're talking about --

MEMBER SIEBER: I don't think it's what you're thinking about.

MR. NAKOSKI: We're thinking vibration induced failures.

MEMBER ARMIJO: Yes, but it all depends on the detail of the construction of the chimney and the flow conditions and everything else.

MEMBER SIEBER: Yes, but performance during an accident I don't think is being tested.

CHAIRMAN CORRADINI: So just to go forward with this, so this would be portable equipment that would come in, do the testing and be removed or essentially installed and kept for monitoring during operation? That's what I was trying to understand.

MR. TALBOT: This is installed and kept for monitoring.

CHAIRMAN CORRADINI: Okay.

MEMBER SIEBER: Are you talking about the dryers?

CHAIRMAN CORRADINI: No. They're saying there's a few components. So we'll just say generally speaking.

MR. TALBOT: Because we still have these issues today.

CHAIRMAN CORRADINI: Okay.

MR. TALBOT: Like Quad Cities has had the steam dryer issue.

CHAIRMAN CORRADINI: Okay.

MR. NAKOSKI: But I would answer the question that I don't know that we're in a position to specifically answer that question right now.

CHAIRMAN CORRADINI: Okay.

MR. NAKOSKI: And it really may be dependent on the long term plans that the licensee would have for kind of a maintenance rule type monitoring of plant degradation mechanisms.

CHAIRMAN CORRADINI: Okay.

MR. NAKOSKI: And I'm not in a position to answer that question.

CHAIRMAN CORRADINI: That's fine.

MS. CUBBAGE: When we came to Chapter 3 we were in the early stages of our review of numerous typical reports that have been submitted on the vessel internals and dryer, and we'll come back and discuss that in more detail.

CHAIRMAN CORRADINI: Okay.

MR. TALBOT: I can discuss that, too, for lead technical review.

MEMBER SIEBER: But there is an issue there. The design of instruments that are internal to a steam dryer if you intend to go back every year or every five years or something like that, the design will be a lot different than if it's at one time tested during startup.

MS. CUBBAGE: Right.

MEMBER SIEBER: The design of the instrumentation.

MR. TALBOT: Correct.

MEMBER SIEBER: Because it's not going to survive.

MS. CUBBAGE: Yes. These are all good questions. We just don't have the right folks here to speak to that.

CHAIRMAN CORRADINI: That's fine. That's fine. But at least we understand the parameter a little.

Go ahead.

CONSULTANT WILLIS: Could I ask you another question. This system has a chimney which is a first of a kind thing?

MR. TALBOT: The chimney is unique to

the ESBWR.

CONSULTANT WILLIS: The internal we don't quite know how it's going to work in full scale under real conditions. Is there some concern about possible vibrations of the chimney or --

MEMBER ARMIJO: Well, that's what I was asking, you know. Under steady state conditions is there any special testing that will be done during initial testing just to monitor whether this structure is vibrating, and it'll depend a lot on how it's built.

MEMBER SIEBER: Yes, it does.

MR. TALBOT: I would have to look at the test extracts. But I didn't see anything on testing vibration of the chimney.

CONSULTANT WILLIS: Well I think you'd would be particularly interested in something new like this which hasn't been used before.

MR. DAHLGREN: This is Chris Dahlgren again.

MEMBER SIEBER: You need a microphone.

MR. DAHLGREN: Okay. I'll stand next to it.

14.2 for startup testing does have a reactor internals vibrations test with the initial startup low induced vibration testing for all reactor internals. And basically we're going to have sensors installed and calibrated prior to the flow testing. Reactor vessel components and structures have been installed and secured as design and expectation of being subjected to rated volumetric core flow.

And it says it includes the steam separator and dryer assembly and reactor vessel head. It doesn't specifically call out the chimney, but it does talk about all the reactor vessel internals.

MEMBER ARMIJO: So you're guessing eventually the chimney will be instrumented in some way --

MR. DAHLGREN: We're going to need to instrument this chimney a lot. Not only for vibration, but also for DP, I would imagine.

MR. NAKOSKI: But I think within the scope of the RAI that we have open with GEH, I think it's something that we could pursue under the initial test program and also as Amy was alluding to in further discussions under Chapter 3. And we don't really have the right folks here to necessarily go any further in Chapter 3. But I think it's a valuable question that we should under 14.2 consider within the scope of actually this open RAI that we got.

MR. TALBOT: Yes. I believe technical review from the branch responsive for this RAI, and we can bring that issue to this attention.

MEMBER SIEBER: Well, if it's not listed, that means you don't have to do it.

MR. NAKOSKI: Exactly.

MEMBER SIEBER: And if you don't have to do it, why would you, right?

MEMBER STETKAR: I think you should do it.

MR. NAKOSKI: That's why I agree that it's a legitimate issue that we should pursue under the scope of this RAI.

MR. TALBOT: Okay. The next RAI 14.2-70. This one had to do with the safety system logic and control preop test. And the staff requested testing of digital I&C system functions.

GEH responded to this RAI and they haven't really gotten into the logic platform that they're going to use for this plant. And they've stated that the level of detail will be provided in detail test procedures. And they've stated that whether they're going to use modulers or controllers they will test the functions. And they also noted that we have the COL holder item 14.2.2-H for the test procedure for the SSLC that would be provided 60 days prior to intended use.

We as the staff did not feel that they described the major functions in the preop test abstract. It was too high a level of discussion for the digital I&C. So we asked them that you stated regardless of what logic platforms if you don't have it now, you're going to still need to talk about the functions and sensor calibration and testing that you need to perform. And so we've asked them to include channel response time, testing, sensor calibration of their six SSLC system channels and sensors.

Next slide, please.

And we have, more or less, the same kind of issue with 13.2-73. Royce Beacom is my point of contact in the I&C branch of NRO and we've been working these issues. And for 14.2-73 this is on the leak detection and isolation systems preop test, again we asked them to discuss interfacing functions and we provided three examples on the slide. And we asked GEH to describe under the test methods and acceptance criteria of the preop test those LD&IS major component functions.

And we also noted that they need to meet RG 1.68 Appendix A. There's an item J, but there's 25 items in there.

Next slide, please.

MEMBER BROWN: Before you go on if you're talking about those, why doesn't the DCIS system fall into the same category, the response time type setup as well? I mean when you go to command something to start, you want it to start not three minutes later an not 30 seconds later or whatever the time is. There is a kind of a command and control time response that you should expect out of everything. And if this is a information system as well, that means that data that's being transmitted from one system into this generalized multiplexed network, whatever it is --

MR. TALBOT: Right.

MEMBER BROWN: -- shouldn't reside somewhere without appearing to operators or being available to operators as soon as it's generated within milliseconds, whatever the time is. And there's no mention of that anywhere in that particular system at all in terms of its time performance. That's 14.2.8.1.7 DCIS system preoperational test.

I mean there's a number of them like that in here.

MR. TALBOT: Very high level discussion.

MEMBER BROWN: Oh, there's no -- well, I'm going to make sure everything works effectively with no other defect;y with no other detail.

MR. TALBOT: Did you notice that maybe the ITAAC had more information in it?

MEMBER BROWN: Well, if I had known where the ITAAC was at that time, it would have been enough. It's fair less detailed.

MEMBER STETKAR: It's somewhat more generic in ITAAC.

MR. TALBOT: Well, on the LD&IS we noticed that for actually the ITAACs for that one had much more comprehensive --

MEMBER SIEBER: The ITAACs fell far--

MR. TALBOT: -- information about what the major functions are. But it was so high level in the initial test program from the individual test abstract, that preop test, that we said you at least even though you haven't chosen your logic platform, you need to tell us what those functions are. They had the functions for LD&IS --

MEMBER BROWN: Well, if there's another--

MR. NAKOSKI: If I can, I think we have someone at the mike in the back. If he would introduce himself.

MR. LE: Tuan Le from Instrumentation Control Branch.

In Chapter 7 and also in Tier 1 we have this commitment to back closure type of commitment to verify all these response times, all these type of things. It's in Tier 1 they are going to perform. I think the question here is in Tier 2 14.2 they should have similar type of these discussion. It's a level of detail concept.

MEMBER BROWN: Well, I don't disagree with that. And I don't think John does either. But it was very, very sparse.

I mean another issue that pops out they talk about verification of synchronization of time signals. Well, that's nice. What if they don't synchronize? What if your stuff goes non-synchronous? What effect does that have on the system?

Now maybe that's buried in Chapter 7

somewhere.

MR. LE: Yes, it's part of this --

MEMBER BROWN: It's not real clear.

MR. LE: It's a part of actually 4603 criteria conformance. So they are in the Tier 1 arena more discuss those things.

MEMBER BROWN: Do they have a test to verify that it continues to work when synchronization is lost or does everything crash?

Same thing applies with multiplexing systems? If they crash what do you do with those? You got to verify that they work somehow. And when they're not --

MEMBER STETKAR: IF they don't work, something else has to work.

MEMBER BROWN: --in the form in which they're supposed to be in the normal operational mode.

MR. LE: ITAAC is for the up to the factory acceptance tests. But those are the similar signal. For these startup tests it may tie to the -- sensors. So that's -- you know, it's beyond ITAAC. So that's what we're thinking.

MEMBER BROWN: Well I haven't figured out exactly where ITAAC is. I mean ITAAC is everything in the factory, has nothing to do with anything when you're building the plant? That's not what somebody told me a minute ago.

MS. CUBBAGE: It's a combination.

MR. WILSON: Jerry Wilson, Office of New Reactors.

ITAAC primarily is a verification of the final in place location. Now in some situations there are factory verifications, but generally speaking it's the verification at the final in place location.

MEMBER BROWN: You put a cabinet someplace and it's actually bolted down? I'm being facetious, slightly, a slight exaggeration but that's what you just told me.

MR. WILSON: Yes.

MEMBER BROWN: And making sure a piece of hardware is in a physical location? That doesn't work for I&C systems.

MR. WILSON: What I'm saying is the verifications that are done are to be done in their final in place location.

MR. WACHOWIAK: This is Rick Wachowiak--

MEMBER BROWN: Being done in the plant?

MR. WILSON: Well, there's a difference between preop startup testing and the ITAAC verifications so --

MEMBER BROWN: Startup event and fuel load.

MR. WILSON: Yes.

MEMBER BROWN: So this stuff has to work before that.

MR. WILSON: Yes.

MEMBER BROWN: From the factory test you can install it in the plant, you've got to have some sort of plant verification that all the communications, all the synchronization, all the multiplex, all the time demands, all the signals, et cetera, et cetera have to be working. And you also have to confirm that if some of them don't, that they don't cause other parts not to operate.

The factory doesn't duplicate every -- this stuff doesn't all come from one guy.

MR. LE: That is the intent of this question --

MEMBER BROWN: And that was my concern when I saw the lack of scope on the preop testing for these particular integrated systems.

MS. CUBBAGE: I think what we're saying

is we're in sync. But I think what you're saying is you had a concern, we had a concern, right?

MEMBER BROWN: Yes. I think mine's -- I saw the concern in the two items raised, which I agree with, but I think it's deeper than that.

MS. CUBBAGE: Okay. Okay.

MEMBER STETKAR: And it's not just Section 14.2. It's because the ITAAC are even less-- much less specific. What happened, you know, DCIS and the ITAAC are separated out into the individual functions. So when you go to SSLC, there's nothing there. I mean, you know it's more high level than the things you're asking for in the ITAAC.

MS. CUBBAGE: I think some of the questions we're getting into here, there's an overlap obviously between 14.2, between the ITAAC and also Chapter 7 the actual design of the system. I know Holbert and some of the other reviewers we've been in discussions with GE about do you need verification of the whole DCIS as installed or is it on a platform basis, or is it on a subsystem basis and how and when do you verify that everything is integrated together.

So I think we are thinking the same thoughts that you are. And you're getting a little slice of it here with 14.2.

MEMBER STETKAR: Later this afternoon if we get there you're going to have kind of an overview of the DAC?

MR. OESTERIE: It'll be a higher level overview of DAC. It's not going to go to the specific details that you're looking for on how to test something that hasn't even been designed yet.

MEMBER STETKAR: It's not been planned to go to a higher level -- to a lower level detail?

MS. CUBBAGE: Right.

CHAIRMAN CORRADINI: Let's keep going.

MEMBER BROWN: I disagree a little bit with that last statement. We know how to test stuff that hasn't been designed yet. You don't know the details of the design of the execution of the test, but the fundamentals of what you have to test are not rocket science. So I understand what you're saying, you haven't designed it yet. That's fine.

MS. CUBBAGE: Well, that wasn't what I said.

MR. OESTERIE: And that's the nature of this RAI. And there are other RAIs that are out there that are addressing these issues as well that are reflected in 14.3

MEMBER BROWN: I couldn't show when the resolution of the items -- not resolution, but it's still open to some extent. It seemed like it was being pushed out and that -- for how long I couldn't tell. I mean what did you read on the previous one? It said we agreed -- that you've asked GEH to include testing the channel response time since the calibration testing of the SSLC system channels and sensors. Okay. You've told them to go do that. You've asked them to go do that. I don't know whether they'll do it or not, but you've asked them to.

MR. OESTERIE: Right. That sounds like that --

MEMBER BROWN: If they do that, you're happy. And when I look at the rest of the similar type issues I wouldn't be happy.

MS. CUBBAGE: Okay.

MEMBER BROWN: Does that clarify that, my thought process a little bit?

MS. CUBBAGE: I think what you're expressing is that you have issues that go beyond the RAIs that you're hearing today. And I don't know that we'll be able to --

MEMBER BROWN: And I understand the

system's not designed. That's part of your test code systems and what you do and what you expect to get out of them and how you test them when they don't operate in exactly the manner that's expected, you have to know that and how is that either incorporated into the system design -- and you have to tell the guy that's what he's got to do. That's not in here. Now there may be some stuff in Chapter 7.

MS. CUBBAGE: There's been a lot of discussion in the Chapter 7 arena on factory acceptance tests and what --

CHAIRMAN CORRADINI: Well I think the take away, I think we've got to proceed here, but I think the take away what Charlie's getting at is there are certain testing principles regardless of design could be enunciated that aren't there.

MEMBER BROWN: Exactly. And you can't take five different vendors, vendor A builds this, vendor B builds this, C, D, E; you give them interface and then pray that it will work. When it gets out of sync -- that's one of the problems with synchronization of systems. As soon as you start having synchronization of systems when you get out of synchronism stuff doesn't work. And you may not know what's not going to work; that's the problem.

You can do. NASA does it and they're controlling the shuttle. So it doesn't say you can't do it, but it costs massive amounts of money in simulators in order to make sure you come up right. And that kind of money is not going to be spent here by any stretch of the imagination. We don't have the federal budget behind it.

MEMBER ARMIJO: It's already being spent.

MR. NAKOSKI: So what I understand the issue is and the take away that I hear that we have is you agree with the issues that we raised in these RAIs?

MEMBER BROWN: Yes.

MR. NAKOSKI: However, it may not be the extent of condition may not have been fully explored in the abstracts that are out there on other instrumentation and control systems?

MEMBER BROWN: And their integration.

MR. TALBOT: Like DCIS for example?

MEMBER BROWN: Yes. Well, everything's--

MR. NAKOSKI: Yes, everything.

MEMBER BROWN: Everything kind of seems

to go through that so --

MR. NAKOSKI: Thank you for that question.

CHAIRMAN CORRADINI: Let's proceed.

MR. WACHOWIAK: I just want to make sure one thing because we've got an interface and synchronization here between different organizations within the NRC. As Amy said, this topic was discussed at length with the Chapter 7 reviewers. So when we're getting into this we need to make sure that the startup test reviewers are in sync with the Chapter 7 I&C reviewers on this. Because this ground has been plowed about 50 times so far.

MS. CUBBAGE: Not with you. Not with the Committee.

MR. WACHOWIAK: But not with this Committee.

MS. CUBBAGE: Not with the Committee.

MR. WACHOWIAK: But within those organizations. And we've had synchronization issues with the I&C and the HFE reviewers. So we're going to bring more parties, we need to make sure everybody stays in the --

CHAIRMAN CORRADINI: Both hands. Let's move on.

MR. TALBOT: Yes. Thank you. Move on.

CHAIRMAN CORRADINI: I get it, though.

MR. TALBOT: Okay. On slide 14 we have the LD&IS functional logics of being tested in a series of overlapping preop tests and GEH did not believe that additional detail was required in the RAI. They had stated that the fifth and sixth bullet of 14.2.8.1.8 had the applicable tests, but at a very high level. And then they mentioned the ITAAC that had additional information in the tables of the ITAAC.

Next slide, please.

And on the basis of this we still have the inspector item for COL holder item 14.2.2-H so we'll get another shot to look at this when they build the plant. But we felt, the staff, that the DC applicant still needs to describe those major functions in the preop test and there was too high a level discussion in the initial test program for that preop test. And we want them to include LD&IS controls, interlocks and bypasses and the major functions that describe those components. And they're actually in for this particular test abstract if you go to -- there's a more comprehensive description of the major functions, but it's not actually in the preop test for this.

Next slide, please.

Slide 16, this one is again on vibration testing during startup for reactor internals. We felt that the description in 14.2.8.2.11 was too broad in general. And GEH, the staff is currently reviewing a number of licensing topical reports. And these topical reports have the information that we requested with respect to the vibration testing. And two items are mentioned there. And so the staff requested that these licensing topical reports be placed into the test abstract.

Next slide, please.

And NEDC0-33408P, that discusses the steam dryer plant-based load evaluation methodology. We've asked them to stick that NEDCO in the test abstract. And that gets into compliance with RG 1.20. And the flow induced vibration loads in combination with other design loads are also discussed in another topical report, NEDE-33313P "ESBWR Steam Dryer Structural Evaluation." And so the staff just requested that this additional information be placed in the test abstract to meet RG 1.20.

The next one has to do with switchyard

testing. So AC power distribution system preop tests.

This originally came out as a COL holder issue or COL applicant issue for North Anna. We had asked for testing of the switch -- North Anna has testing of the switchyard in their application. However, North Anna has now decided to take that test abstract out of their application and have the DC applicant address it under 14.2.8.1.3.6. And that test abstract actually had the same test methods as the switchyard test abstract that North Anna had in their application.

Go to the next slide, please.

The first five on page 18 and the next three on page 19 involve testing the switchyard. It was exactly the same functions.

We agreed that they could put it in the DC application. However, the staff identified that there were two other issues in 14.2.8.1.3.6 that needed to be addressed. And that was to verify analytical dry voltage values and voltage analyses for the onsite distribution system to meet a branch technical position, BTSB 1, and proper operation of automatic transfer capability of normal preferred power to alternate preferred power.

And that basically is the status of five RAIs that are still open. And any other questions you have?

MEMBER STETKAR: Yes. On the switchyard when I was trying to look through my notes, as I read the open item the concern was primarily with respect to capacity of the offsite power supplies, at least the summary that I read. You have more information here on your bullets.

MR. TALBOT: Yes.

MEMBER STETKAR: My question was related to -- and I want to make sure I understand really what your concerns are here. In the Tier 1 DCD documentation GEH has drawn a dotted line that defines the boundary between what they call onsite and offsite power. That dotted line is on the high sides of the disconnects on the supply -- the plant transformers. Essentially onsite excludes the switchyard.

In recent license renewal applications the staff has maintained that the scope of the onsite power supply systems should extend out to include the first active circuit breaker in the switchyard that can be used to reconnect offsite power. This is for offsite power recovery.

Does your open item cover both the power supply capacity and where you draw that dotted line or not?

MR. TALBOT: I'm not sure I can answer that question. I might need to --

MEMBER STETKAR: Because I was curious about, you know, in terms of the testing program whether it's the 14.2 tests or the -- in the ITAAC the "transmission system" is specifically excluded from the ITAAC.

MS. CUBBAGE: Excuse me.

CHAIRMAN CORRADINI: I think you have an answer on it.

MEMBER STETKAR: Okay.

MR. RHOW: My name is Sang Rhow.

I didn't review the Chapter 14, but I reviewed the Chapter 8 for the ESBWR.

Their ESBWR is a unique system. They're using the islanding mode. Even if problem in the offsite power, their onsite -- I mean the main generator provide the power to the housing we call the hot air load onsite.

But your question -- I'm going to answer your question. Normally boundaries is between the high side of a generator -- high side of a circuit breaker to the switchyard usually -- usually it has a break in half scheme. Do you understand the break in half scheme?

MEMBER STETKAR: Yes. Yes, I do.

MR. RHOW: Yes, You can isolate it to two breaker from the grid to the generator, therefore up to the high side of the circuit breaker is onsite -- onsite the system.

MEMBER STETKAR: Well, without going into detail on specific --

MR. RHOW: I give you the little bit description. Generator, stable transformer or to -- before happening to the onsite there is a circuit breaker.

MEMBER STETKAR: It depends on the plant design whether you have a generator breaker or whether --

MR. RHOW: This is up to -- there's the high side of the circuit breaker -- and go to the switchyard.

MEMBER STETKAR: Right.

MR. RHOW: There is definitely on the utility. Some use break in half scheme, some theoretical --

MEMBER STETKAR: Could have anything?

MR. RHOW: Yes. That happening point there is a disconnected switch. Any problem this gauge how operator disconnect and switch. Open up the disconnect and switch. It doesn't have a capability interrupting for the current, but once you close -- open the breaker, you can remote control to open up the breaker.

Up to the happening point is onsite in the --

MEMBER STETKAR: Okay. That interpretation seems to be different than the interpretation that the staff has used in their license renewal applications, which has said that the scope of the onsite shall include the active circuit breaker in the switchyard, whether it's breaker and a half or ring bus, or whatever the configuration is. They've required the utilities to perform testing and inspections of everything out to include that circuit breaker. And that's the basis.

MEMBER SIEBER: The structural components.

MEMBER STETKAR: Structural components, that's right. But in terms of drawing the dotted line about what belongs within the scope.

MR. OESTERIE: This is Eric Oesterie --

MEMBER STETKAR: So my question was I recognize your concern about the capacity, you know, the power supply capacity of the redundant power supplies, and that's certainly a vital concern. But I did have the question from a functional testing perspective specifically because the ITAAC exclude what I'm interpreting as anything on the offsite power side of that dashed line.

MEMBER SIEBER: Yes, above the dotted line.

MEMBER STETKAR: Above the dotted line is outside the scope of any testing requirements.

MR. OESTERIE: Eric Oesterie from the staff --

MEMBER STETKAR: And that by definition excludes those circuit breaker -- those switchyard circuit breakers.

MEMBER SIEBER: True.

MR. OESTERIE: Under the review of the ITAAC we do have an RAI outstanding with GEH talking about the need for site interface requirements to test the offsite power systems. And so we're still working with GEH on the specific language that would be acceptable to put in there. And I think we've reached pretty much agreement on it.

It requires the COL applicant to come up with ITAAC to test those offsite power components that you're concerned about. And there'll be some discussion about that tomorrow morning.

MEMBER STETKAR: Okay. Put it off.

MS. CUBBAGE: Right. Because --

MEMBER STETKAR: Good enough.

MS. CUBBAGE: Yes. The scope of the certified design versus the scope of the site specific features. And then there's the dividing line between offsite/onsite --

MEMBER STETKAR: I'm a bit sensitive to this because we've had a lot of discussions about where you draw that dotted line in a --

MR. OESTERIE: We have, too.

MEMBER STETKAR: -- license renewal space. And it is a licensing issue.

MS. CUBBAGE: Right. But design cert space you also have the complication of the generic standard design versus the site specific features, and the switchyard is site specific.

MEMBER STETKAR: That's right. But I mean that still is a COL issue.

MR. OESTERIE: Right.

MS. CUBBAGE: Yes. The COL is the --

CHAIRMAN CORRADINI: Other questions? Thank you very much.

Eric, you're going to come up and educate us before we start 14.3?

MR. OESTERIE: That's my goal.

CHAIRMAN CORRADINI: Okay.

MR. OESTERIE: For some of you I'm sure it'll just a refresher. Not for me. Certainly not a refresher for me.

MEMBER SHACK: Yes, right.

MEMBER BLEY: You have to be educated about ITAAC before we do ITAAC.

CONSULTANT KRESS: What it stands for.

MEMBER STETKAR: I'm surprised. I thought I knew what Tier 1, Tier 2, ITAAC and DAC was and then I missed the Tier 2 star. And now I can't figure out whether Tier 2 star is like between Tier 2 and Tier 3 or between Tier 2 and Tier 1. I think it's between Tier 2 and Tier 3.

MR. OESTERIE: There's no Tier 3.

MEMBER SHACK: But will your explanation agree with their explanation.

CHAIRMAN CORRADINI: Eric, go ahead.

MR. OESTERIE: Okay. Thanks.

Well thank you everyone. My name is Eric Oesterie. I'm the lead project manager for essentially 14.3 of the ESBWR in Tier 1.

In discussions with Dr. Corradini, we agreed that it would be a good idea to do an overview on the use of Tier 1, Tier 2, Tier 2 star, ITAAC and DAC as used in design certifications as either a primer for the presentations tomorrow or as an education, if you will, to some of the members that haven't been through this on other design certification applications.

You can go to the next slide.

So my purpose this afternoon is to provide an overview and historical perspective on the use of Tier 1, Tier 2, Tier 2 star, ITAAC and DAC for design certifications to support the presentations tomorrow.

And in this pre-election season where rewriting of history is in vogue, I brought Jerry Wilson with me, who is a senior staff member who was present during the creation of these concepts and deliberations on these concepts to ensure that any rewriting of history that I do is unintentional.

MEMBER STETKAR: Did he have to take an oath or something?

MR. OESTERIE: It is. Context is everything.

Back in 1989 when we started going through development of Part 52 associated with implementation of Part 52 rule we had a number of policy issues to deal with. And they included ITAAC and DAC, Tier 1, Tier 2 and Tier 2 star.

This slide identifies a number of policy papers that went up to the Commission that discuss these concepts and got Commission approval on some of these concepts. And, hopefully, I'll go through them briefly with you.

What I do want to point out and make sure that everyone understands is that Part 52 is also known as a process rule, meaning that it doesn't impose for the most part any new technical requirements for licensing of certifications and power operation of plants. It does all the same things that Part 50 did. So when you compare the two we do all the same things under Part 52 that we did under Part 50, except they're grouped or segmented in different bundles, if you will, and the timing is a little bit different.

During the development of the Part 52 rule some of the feedback that we got from industry was that they wanted predictability or more predictability in the licensing process. And I'm sure you've heard stories of the "rogue inspectors." And so utilities wanted to know what would be inspected and what would the acceptance criteria be. And in response to those concerns, the concept of ITAAC was developed along with the concepts of design certification that's allowed under Part 52. That's under subpart G. We also had the early site permit, which is under subpart A, but we're not going to talk much about that today. And COL combined licenses under subpart C.

There are other licensing vehicles that Part 52 did provide flexibility for: Final design approvals, manufacturing licenses. But for the most part those won't be pertinent to the discussions this afternoon.

SECY 90-377 really identified the level of design detail necessary for a design certification. It introduced a two tiered approach, meaning Tier 1 and Tier 2. And that allowed for flexibility in change processes for the information that's provided in Tier 1 or Tier 2. And it also introduced the graded approach. And what that meant was that the level of design detail necessary for the safety related or important to safety or risk systems was generally deemed to be higher than for those that were not safety related or not important to the risk.

Just as a comparison or to put into context, the Tier 1 document for ESBWR fits in one volume like this, whereas the Tier 2 information which is typically considered on the same level of detail as an FSAR and the time SECY 90-377 was written it was said that for the same level of design detail as plants that were licensed to operate at that time. Well, just for a context viewpoint, prior to that time we had plants that were licensed with four volumes of an FSAR. I'll give you an example. Turkey Point, that was a proposed GDC plant that was licensed, and it only had four volumes.

After I got done working there after a year and a half or two years, well there was five volumes and one volume was all fire protection stuff. And ten years later or 15 years later or more even prior to SECY 90-377 coming out we had plants like Palo Verde that were licensed in 1985 through 1987 there were three units. And they had about 24 or 25 volumes of an FSAR. I think ESBWR has about 12 or so volumes of Tier 2 information.

We'll get to Tier 1 and Tier 2 and Tier 2 star a little bit later.

The Commission approved the design certification concept and the two tiered approach and the graded approach for the information. In SECY 91-178 the concept of ITAAC was approved, and that was in response to the previous concerns that I've explained and described that we heard from the industry about predictability on inspections and what the acceptance criteria for those inspections would be.

That SECY paper also identified a two step approach for ITAAC as well, the first step being ITAAC that are generated for the certified design and ITAAC that the COL applicant that references a certified design needs to come up with and supplement the DCD ITAAC with, and that would be site-specific ITAAC for things like, say, plant service water. And we've seen ITAAC for things like engineered backfill. We also have ITAAC for emergency planning that the COL applicants have included in their applications. And that's not something that got put into DCDs.

SECY 92-053 -- well let me back up. SECY

91-210 really extended the use of ITAAC to the things like final design approvals, manufacturers' licenses.

SECY 92-053 introduced the concept and use of design acceptance criteria. During the staff's reviews of the initial applications for design certification that we had in the early to mid 1990s, those were the ABWR and the System 80+ the feedback and experience from the staff's review of those applications determined that in certain areas there was not sufficient level of design detail for them to make their determinations. And there were some areas that was it deemed by the staff and the Commission that involved rapidly changing technology that we would not want to lock down in a design certification where the technology may be outdated already when a COL applicant chose to build a plant using that technology.

So the concept of design acceptance criteria was introduced and approved by the Commission. And I'm going to get into that a little bit more later in detail in the following slides. I just wanted to lay some more of the ground work and fundamentals for the policy first of all.

CHAIRMAN CORRADINI: So just for my own

edification, except for the one you just talked about for the DAC, the first three just kept on better defining the process of using ITAAC for design certifications and POL?

MR. OESTERIE: Yes, that's essentially correct.

CHAIRMAN CORRADINI: So nothing changed conceptually? There was more specificity as to what was acceptable?

MEMBER SIEBER: More applications.

MEMBER BLEY: Eric, I thought you said 210 extended the ITAAC to final design approval, which is conceptually a little different.

MR. OESTERIE: Right.

CHAIRMAN CORRADINI: Well, I was going to go back and ask what that was. I don't appreciate that.

MR. WILSON: Yes. Let's not get bogged down in 91-210. It's become out of date since we issued a update to Part 52.

But back to Dr. Corradini's point, these papers 90-377 and the other ones were working out how to implement the rule. Remember the rule went into effect in 1989. And so they're in the mode of reviewing two design certification applications and we're working out the details of what sufficient level of information and what are the ITAAC going to look like, how's this actually going to work. So that's what the purpose of these papers were for.

CHAIRMAN CORRADINI: And then the two are the ones that Eric will refer to, but it's down there in 214? Those were the ones that were in the hopper that were being worked on, right?

MR. WILSON: Yes.

CHAIRMAN CORRADINI: All right. Thank you.

MR. OESTERIE: Right. So again, 90-053 introduced the concept of DAC and how we would use that in design certifications, and I'll get to that in more detail later.

92-214 provided a status of the staff's reviews of ITAAC for the ABWR and System 80+. And dabbled a little bit with the concepts of specific ITAACs and generic ITAACs. But that's kind of kind by the wayside with much more. We've ended up with much more specific ITAAC and some nonsystem-based ITAAC in design certification applications.

It also talked about the relationship between design descriptions that are provided in the Tier 1 document to the ITAAC and basically says that the design descriptions will ensure the configurations for the life of the plant. Under Tier 1 that information gets certified so it goes through a higher level of approvals for any changes to be made than the Tier 2 document does.

If we could go the next slide.

The regulations specific to design certification applications and the use of ITAAC for design certs are provided in 10 CFR 52.47(b)(1). And that's just for the design certification only. There's another regulation that -- and that's just for the scope of the certified design. The other regulation that deals with ITAAC is 52.80(a), and that is for the COL applications. And that requires ITAAC for the entire facility.

So when a COL application references a DCD, all of the ITAAC from the DCD get incorporated by references to the COL. The COL applicant has to provide its own site-specific ITAAC, which would include emergency planning ITAAC for plant service water systems, engineered backfill, emergency planning, et cetera.

And also includes any ITAAC that are identified in the DCD under the site interface requirements. We talked about that a little bit earlier on the offsite power systems. Currently the ESBWR talks about the need for COL applicants referencing the ESBWR DCD to provide ITAAC for the plant service water system and we're in discussions with the GEH about including similar type of requirements for offsite power systems.

MEMBER BLEY: Eric, could I sneak a question in?

MR. OESTERIE: Sure.

MEMBER BLEY: Don't answer it now. I just want to get it in so as you go through you answer it in kind of the right place.

I have a kind of a guess, and I've heard from some people, not Jerry, but others who are involved in this as it began that in the beginning people thought you might get a complete design that wold get certified and you'd just replicate it and as it went on it became clear that some parts of it couldn't get there. And those documents you showed us showed some of that. My question, which I hope you'll get to, is for those parts of the design that aren't there at this stage that we're at with the ESBWR but are substantive, large pieces of the design, where in this process if anywhere do they get the kind of deep review and questioning like the

RAI process to give them an equivalent basis as we've got for the rest of the design that you've already questioned?

So if you can get to that wherever it comes up, that's one thing I'm really interested in.

MR. OESTERIE: Yes, and I'm going to ask you a question back. Are you talking about DAC?

MEMBER BLEY: I don't know. I hope I am, but I don't know. From what I've seen, I haven't seen that that ever happens again, and that's what I'm curious about.

MR. OESTERIE: And the reason I asked is because there is some discussion in one of these SECY papers, and I don't remember exactly which one it is, but it does talk about what processes the staff has available to it to look at the information that they need to make their reasonable assurance findings. And if you're talking about DAC, in summary it's a process that we'd be looking at that results in a predictable outcome in terms of what the design should be and meets a certain set of criteria.

MEMBER BLEY: Yes.

MR. OESTERIE: That being part of ITAAC by regulation does not need to be completed by a COL applicant in order to get its license. However, the flexibility is in the regulations to allow some of that to happen. In fact, the design certification vendors that we've been working with we've actually been pushing to try to get more of the DAC items closed during the COL application review process rather than waiting until after the license is issued.

MEMBER BLEY: Yes.

MR. OESTERIE: But after the license is issued, then we're into traditional inspection space. And so we do have the availability to review completion of those designs under DAC and ITAAC to ensure that they meet the acceptance criteria. In fact, the COL applicants have to demonstrate that to us. And we're working with the applicants to develop schedules so that we can assign resources and go look at their completed designs before they get implemented in the plant.

In some areas it's easier to do, like within piping where you've got ASME code requirements that they have to meet. And it's a lot more prescriptive in those areas than it is in, say, digital I&C. We're still kind of working that out.

There are other areas that the staff or

the processes that the staff has available to them in terms of audits during the design certification application review or the COL application review to ensure that sufficient information is available to support the staff's reasonable assurance findings.

MEMBER BLEY: None of that sounds like the kind of integrated look and questioning process we get with the RAIs like we've been seeing for the part of the design that's in place now. Am I right in that or am I off someplace?

MR. WILSON: This is Jerry Wilson. Let me jump in here very quickly.

When the licensee and their contractors implement the design acceptance criteria, they're going to create that design information. They're going to notify the staff that that design information is finished and available. And we're going to do a review.

Now unlike normal ITAAC that is part of our construction inspection program, we envision the headquarter staff will be assisting in that review and they will be doing a review very similar to what we would do if that information was provided in the design certification application.

MEMBER BLEY: I like hearing that. I

didn't get that when I read the documents about it.

MS. CUBBAGE: Right. And also I do envision, as I believe GE's proposing, that they may submit topical reports for staff review and approval such that the COL applicants could later point to those approved topical reports a the basis for their ITAAC closure for the DAC areas. So in reviewing and approving those topical reports, we would be in a review in an RAI mode. And then we would verify that the COL applicant is implement is implementing that approved method. That's one possible way that the ITAAC could be closed. It's not a requirement that it be done that way.

MEMBER BLEY: I guess where I'm hanging is if you do this at this point, then you could do a little more and a little more and maybe the whole design could come in this way. And are we really getting the kind of review for the latter parts of the design that we get for the early parts. And what Jerry said is yes. And I hope that's true.

MR. WILSON: Yes, but let me address your address your additional point. As Eric was pointing out, the industry asked that in certain areas they not provide detailed design information because of rapidly evolving technology. The

Commission agreed to that, but it's on a case-by-case basis. So each application in each area needs to be approved by the Commission. And the Commission is there looking at it to be sure it doesn't get out of hand. We have the same concern that you just raised. We don't want the whole application coming in like that. We want to keep this limited to those situations that are justified.

CHAIRMAN CORRADINI: So but can I just clarify? So that in the three areas that were listed in the Appendix under Chapter 14.3 those are the only three that are now generically allowed to take this approach or did you say something different that every new certification and associated plant design will have to get those three approved and it may not be?

MS. CUBBAGE: Well, it's approved through the rulemaking process for each certified design.

CHAIRMAN CORRADINI: There is no generic DAC approval?

MR. WILSON: Yes, that's the correct answer. Is there is no generic approval. It's a case-by-case approval.

Now let's deal with the facts here.

Technology does not always rapidly evolve. At some point digital I&C is going to slow down and we're going to say no more DAC. I mean, it's not today but I can see it in the future.

MEMBER STETKAR: Why isn't it today? You know, I agree it was not 20 years ago when a lot of these things were written. But that was 20 years ago.

MR. WILSON: Well let me tell you how I've handled this on a case-by-case basis. As we come down to the final pool stage, I go to the senior staffer in each of these areas and ask them is it still rapidly approving at this point in time so we approve it on this particular application. And I've done that on a case-by-case basis.

One of these days the answer's going to be no, and then we're going to send something to the Commission and say we don't think this particular applicant should be able to use DAC in this particular area.

CHAIRMAN CORRADINI: But let me just push the point. So you said that you said in the previous slide -- you don't have to go back, it doesn't matter. But in the previous couple slides that ABWR and System 80+ were on the docket when all this was evolving.

MR. WILSON: Yes.

CHAIRMAN CORRADINI: Okay. Then came through AP-1000 --

MR. WILSON: Well 600.

CHAIRMAN CORRADINI: Six hundred, I'm sorry. Excuse me. Then turned into 1000, but 600. And that was at this stage.

So the possibility exists that as we're going -- possibility now only. That as we're going down to EPR and APWR some of these three that have historically in the last couple of decades been on our DAC, could be pulled off because you have a warm feeling by staff that things are slowed up en9ough that they can and should have more detail design up front?

MR. WILSON: Yes.

CHAIRMAN CORRADINI: Okay.

MEMBER BROWN: You could argue, nobody's going to like this, but you could argue that microprocessors have been around now for 26 years. I mean, we designed the first systems in 1980 in the nuclear program. A microprocessor, they work the same, they've got step programs, memory is memory it's just more of it, buffers are buffers they're just better at doing what they're buffering. D to A converters are D to A converters, the technology they're roughly the same. So technology is not really evolving. The parts change. Somebody designs a new part. But that's no different than when we did transistorized stuff and we went from one set of transistors to another one. And that wasn't viewed as rapidly evolving, it was just a different set of transistors.

So I mean I would make the argument that we're well past the point in distributed systems, networks, et cetera have been around for 25 years or more. And I really don't agree that this stuff is rapidly evolving and that we should be accepting lack of detail in these.

Now the parts are different inside the boxes, so what? It's still got digital IO, it's got buffers, filters to keep data from being corrupted; six of one, half dozen in another.

So if you asked me, I would have stopped this a long time ago.

MR. WILSON: If I may, depending how the Committee feels on this, I think it would be useful for the Committee to write a letter to the Commission on that subject. And I'm sure the staff would be interested --

CHAIRMAN CORRADINI: On a generic basis, though. I don't want to hold up the applicant that's in front of us now.

MR. WILSON: Yes. Right. Thank you.

MEMBER BROWN: No, I wouldn't do that. But it's the rational thought process to walk ourselves through to see where we are today and why we're still working with this idea that it is rapidly evolving. It's different parts. But I'm talking about trying to --

CHAIRMAN CORRADINI: I understand.

MEMBER BROWN: I agree with you on that.

MEMBER STETKAR: And I'd add just one thing. I agree with you, Charlie. And the benefit of having more detailed design information is not on the brand of chip set that I'm going to use.

MEMBER BROWN: Absolutely not.

MEMBER STETKAR: It's the philosophy of how the system is really going to work. It's how all the pieces are tied together. So you look at that integrated design. You don't care about the individual piece parts. You care about what functions are going to be in there, what relative timing is among those functions, interlocks, bypasses, permissives; all that sort of stuff within the context of a particular plant design.

MEMBER BROWN: Exactly.

MEMBER STETKAR: And when I think of design, I don't think of who is going to manufacture the chip set. I think of how is that system going to work within the context of the rest of the nuclear power plant. And the sense is that there's an awful lot of reliance on the fact that chip sets are becoming smaller and faster as a surrogate for saying well we don't need to provide the more important information --

(Off the record from 4:12 p.m. to 4:13 p.m. for technical interference.)

MEMBER BROWN: -- point of how do you operate in the system. It's the fundamental -- do you use a main operating loop, do you use an executive system with interrupts, et cetera, et cetera. And we've been doing those for a long time.

MR. OESTERIE: Stop there because it falls into that category of stuff as well.

CHAIRMAN CORRADINI: But that helps. So I'm sorry.

MR. OESTERIE: But just as an example, progress has been made. The ABWR I think included radiation protection as a DAC item. And the recent design certification applications did not. So we are making progress.

To provide guidance to the staff and also to the applicants on use of DAC and ITAAC, SRP 14.3 was initially drafted in '96 to provide guidance to the staff on review of ITAAC and DAC. It was largely based on staff's experiences reviewing ABWR and System 80+ and AP-600. It was updated in March of 20007.

We also developed RG 1.206. And I think some of you were here when we presented DG 1145, which was the draft RG 1.206 and had some of the discussions on the guidance that we included for COL applicant to include ITAAC that was provided in Section C.II.1. But we also included some discussion on DAC in Section C.III.5 and some additional guidance in Section C.III.7 for COL applicants referencing a certified design and/or an early site permit. Some early site permits did include some ITAAC, but I think on a very limited basis. So that talked about what COL applicants had to do in terms of site-specific ITAAC and when they reference a DCD and/or an ESP.

Next slide, please. Thanks.

So before we get to talking about the differences between Tier 1, Tier 2, Tier 2 star and what are they, I'm going to start out with Tier 2 because that includes the basis for the design of the plant. It contains all of the FSAR information.

It is defined in every design certification rulemaking. If you look in the appendixes to Part 52 there are definition sections for each of the certified designs in there that include the definitions for Tier 1, 2 and 2 star.

Tier 2 if you look at item number one in there includes all of the technical information and basis for the design with the exception of generic tech specs and conceptual design information. Conceptual design information is something that is provided to assist the staff with their review, but does not end up getting certified as part of the design. And the COL applicants have to provide a no kidding design to replace that conceptual design.

Tier 2 may also include information on how certain tests that are specified in ITAAC need to be run and what certain analyses may need to include or what the contents of certain reports that are specified in the acceptance criteria for ITAAC need to include.

The Tier 2 information also includes all of the COL items that the COL applicants are required to address. And that also gets rolled into the rulemaking as a requirement by regulations of any COL applicant that references a DCD.

Typically those COL action items are largely related to site-specific design issues and/or operational matters that the COL applicant is responsible for.

One of the things that differentiates Tier 2 information since it is FSAR-like information is the change process for changing information in that part of the design certification. And that change process is specified in Section VIII B of the design certification rule and you have to go through a "50-59like process," a series of questions which you answer to determine whether or not you have to come to the NRC to get prior approval for making the change.

MEMBER BROWN: Point of clarification.

MR. OESTERIE: Sure.

MEMBER BROWN: You said that the COL normally only has to deal with the site-specific stuff. They've got the standard design, the specific design that the applicant is utilizing.

And I'm trying to understand that. I may be ahead of you. But then when we looked at Chapter 14 there were three areas, piping design, the control acceptance criteria for digital I&C and human factors; three DAC things.

MR. OESTERIE: Yes.

MEMBER BROWN: Now those all had the COL had to provide. I mean, it says the COL license must would have sufficient information to provide whatever procedures, et cetera, et cetera.

MR. OESTERIE: Yes.

MEMBER BROWN: And that was not subject to the same oversight, at least I was gathering that, other than as an acceptance criteria that all the earlier design information was subjected to. In other words, we've gone through all this design certification, you've got all the Tier 2 stuff and people are looking at piping diagrams and squib valves and blah, blah, blah, all that other good stuff. And the DAC stuff is kind of this amorphous cloud of very generic, nonspecific information which some guy generates later. You like my words, huh? That nobody ever sees other than maybe somebody inspects something later. But no one ever reviews the design. Does that --

MS. CUBBAGE: But in lieu of those design details --

MEMBER BROWN: That's what she just said.

MS. CUBBAGE: In lieu of those design details we do a thorough detailed review of the acceptance criteria and the design process. And the design process should be --

MEMBER BROWN: The design process in what way?

MS. CUBBAGE: Well, I'll give you an example. For the human factors area we've reviewed about a dozen topical reports and we make sure that there's enough detail such that if they implement the process in those topical reports, we come to a finding that they will achieve acceptable results. And then --

MEMBER BROWN: That's a passthrough from GEH to the COL?

MS. CUBBAGE: Absolutely. Those topical reports are incorporated by reference into the DCD, become Tier 2 star which Eric will get to shortly, and they have to follow that process or they have to get our approval for an alternate process.

MEMBER BROWN: But the design details,

you just look at an output. Topical reports say we're going to design this in a certain way, but you don't ever get to look at designs. So on this --

MS. CUBBAGE: We do. We don't get to look at it in a traditional review and approve and license mode.

MEMBER BROWN: Yes.

MS. CUBBAGE: We get to look at it in detail through the inspection process. I think we need to --

MEMBER BROWN: What's inspection? I mean somebody submit the block diagram, the schematic diagrams, the software source code?

MS. CUBBAGE: All of its available to us to make our finding.

CHAIRMAN CORRADINI: So just for clarification--

MS. CUBBAGE: We're actually going to look at all of the DAC items, it's not a sampling.

MEMBER BROWN: You folks will?

MR. WILSON: Jerry Wilson.

As I said before, it's our expectation that that information will come and be reviewed by headquarters reviewers. It will not be reviewed by our inspectors.

CHAIRMAN CORRADINI: Right. But it's within the inspection construct that you'll see it?

MR. WILSON: Right. Because it's pat of ITAAC.

CHAIRMAN CORRADINI: So maybe it's a control issue. So I'll make a joke out of it. But maybe it's a control issue, but in essence we're out of the loop? That is once we see the it should do this, it will have these attributes to do this and we will feel good when it does this, and we say yes that looks good enough for these fast evolving areas of piping, human factors and digital I&C, ACRS is out of the loop?

MR. WILSON: That's correct.

CHAIRMAN CORRADINI: Okay.

MR. WILSON: Consistent with past --

CHAIRMAN CORRADINI: Okay. I just want to make you're clear about it. That's what I sense is an underlying worry here.

MEMBER BROWN: You said what I didn't say. Thank you.

MS. CUBBAGE: Okay. Well now I see the angle. But from an agency perspective --

CHAIRMAN CORRADINI: We got to think about job protection.

MS. CUBBAGE: From an agency perspective, though, our inspection processes is part of the regulatory process.

CHAIRMAN CORRADINI: Okay.

MEMBER STETKAR: And in particular for ESBWR though as I understand it, those inspections will only occur after the COL is issued, right. It's between COL and fuel load is the time window for that?

MS. CUBBAGE: Right. It's not out of the question that there may be some documents that could be submitted or made available before we issue a license. But the expectation is that we're not going to have any of these documents available until after licensing --

MEMBER STETKAR: But in practice that gives you very limited capability to really affect anything of the design once its built.

MS. CUBBAGE: Oh, no. I think that's a key point is that we are fully expecting that we're going to do the verifications on the design portion, the DAC, prior to them installing and constructing anything.

MEMBER BLEY: But there's, I guess, two quick things in Mike's casual comment a minute ago.

It's not just the ACRS not looking, although I'm a little concerned about that. From what I read in the documents I don't see anything that requires the kind of review from staff that Jerry described, which I would like to see. And the third piece of it is from a standpoint of logic if it's good enough for this hunk of the design, couldn't you do it for the whole thing and could it evolve that way? I know that's not the intent.

CHAIRMAN CORRADINI: But he answered that part of your question.

MEMBER BLEY: Well, he answered it in terms of intent. But if it's good enough for part, why isn't -- it could evolve that way in the future. And I guess I'm not comfortable with that whole construct of things that are being done, probably going to happen the way they're described, but aren't required in the limit.

I think we've covered it already, John.

MEMBER STETKAR: Yes, it's a good example. It's a good example.

We were talking about this earlier is that when you speak about the staff's review of the DAC and the ITAAC, something I stumbled across. Apparently there's some design information, reasonably detailed design information about the digital feedwater control system for the ESBWR. And the staff has raised several concerns about possible response to failures, you know, it's a three element controller during normal power operation, single element when the plant is shutdown and so forth. Those are design details. And the staff has raised concerns about how will the preoperational testing program either in 14.2 or at a somewhat higher level in the ITAAC evaluate the effects of changes in values of each of those elements. You know, for example steam flow. They don't call them out as steam flow, but it's an example.

That's a very detailed concern about how detailed is the testing program to verify the function of this controller. Now that feedwater controller is a small relatively well behaved, relatively well known item. And yet the staff has raised detailed concerns through this review process, through the systematic review process.

On the more integrated ITAAC, DAC for the safeguards actuation, whatever it is, SS -- I've forgotten all of the acronyms. SSLC. The overall digital I&C platforms, there are no questions at that level of detail. There's no -- I don't see where the process provides the staff the opportunity to ask those questions before the system is already built and installed in the plant.

MEMBER SIEBER: Or access vulnerability.

MEMBER STETKAR: At which point it's very hard to say oh, gee, we have a concern about the fact that -- I don't know. This combination of input signals if they fail high, may create a difficult situation to deal with.

MS. CUBBAGE: Well, if they've proceeded to their detailed design and they've come to us to say that we're ready to close that part of the DAC, then we can look at what they've done in the context of the acceptance criteria, which in the case of the I&C the requirements of IEEE 603, the prescriptive regulatory guides implementing that standard and we can raise issues of whether or not the design that they have completed fulfills and meets those criteria.

MR. WILSON: And recognize in this what we're talking about and how we got to where we are in design certification from the way we used to do construction permit reviews is that the goal was to get design issues resolved prior to construction. On this particular area industry has asked to, in effect, defer those design reviews in these selected areas. So that meant industry is incurring a bit more risk than they would have if they were to have resolved it before they started construction. So these types of risk issues and us raising concerns late in the game that may effect what they're installing is all part of the deal.

MS. CUBBAGE: Right. There's no restriction against us raising issues. It's just that it's, as Jerry said, that the risk goes up to the applicant the further along they go.

MEMBER BROWN: But you don't have to give a response. I mean, they send it to you. If they don't hear from you --

MS. CUBBAGE: We have to make a finding that we agree that they've closed every ITAAC. It's not a negative consent.

CHAIRMAN CORRADINI: It's not hearing nothing, it's assent. I just want to make sure. This is where I think we want to be clear.

What I'm hearing you say is, is that that information which you can ask RAIs and get information on, you have to feel that that ITAAC and that issue is closed before they can proceed?

MR. WILSON: That's correct.

CHAIRMAN CORRADINI: The additional detailed information that would be forthcoming?

MS. CUBBAGE: They have to provide adequate information to demonstrate that that ITAAC or in this case DAC has been closed and we have to agree before they'll be authorized to load fuel.

MR. WILSON: But understand, back to the previous line of questioning about the design work ongoing while the plant's under construction and in the design review and in later installation of digital I&C, the licensee is not constrained in a step-wise fashion. They can continue to proceed even though some of those ITAAC have been officially reviewed by the staff, that they're proceeding at their own risk. Well, they're trying to get the plant done so they're going to continue to march along and once they have that design done, they're going to start installing it. We're going to do our job and try and do our review of that design information, give our feedback as quickly as possible. But there could be problems. That's why I say the whole adoption of this design acceptance criteria in lieu of detailed design information incurs additional risk for licensees. And that's the trade-off. The licensees are buying these designs with a portion of the plant not designed. And they do that with that knowledge in advance.

If they didn't like it, they'd go back to the vendors and tell the vendors to finish the design before they start construction.

CHAIRMAN CORRADINI: I'm sorry. Somebody wants to make a comment.

MR. ASHCRAF: My name is Joe Ashcraf. I'm from the I&C branch, too.

One of the things that's kind of not discussed here, but when we get into the detailed design review for digital I&C anyway, you have the life cycle process. So, you know, it's not really -- some of it could be DAC and some of it could be ITAAC. But as they complete each phase we will be able -- and he used the term "audit." We're not supposed to use that term. But we will be able to review to whatever degree we want to for that phase. And each phase progresses in a total design such that if they're following their plan, and whatever we choose to look at, you know, leads us to believe that they are, at the end of the day the final product should work as required.

And part of the design detail that you're talking about is really going to happen up in the first couple of phases as far as the requirements and the functions and that sort of stuff. And a lot of the later phases it's just more the testing and some of the other aspects of it.

CHAIRMAN CORRADINI: So let me just ask since you're up and volunteered. Because I'm clear now how you guys are going to -- I think I'm clear on how you guys are going to do it. So let's just say in that process they're going to put in, I don't know, let's just use his feedwater controller or something similar. They're going to put in something that upon the design details you have a concern and you raise some RAIs, or you ask them questions, you get some response and then you still have a concern. But they're proceeding along at their own risk and they install it. And now you're still concerned. Therefore, they may have to uninstall it and put in a component that meets and satisfies your concern?

MS. CUBBAGE: That's exactly the risk that Jerry was alluding to, yes.

CHAIRMAN CORRADINI: Right. Okay.

MR. OESTERIE: It has to meet and satisfy the acceptance criteria.

CHAIRMAN CORRADINI: I'm sorry. But in

some sense the staff's discussion of it wants to get to feeling good about the acceptance criteria and something is hanging them up. Okay.

MR. WILSON: Right.

CHAIRMAN CORRADINI: Things can be --

MS. CUBBAGE: And in light of that, you know Jerry's right that there's no requirement that they go through this in a step-wise fashion and get interim staff feedback. But given that the inherent risk involved with the DAC process, GE and we will expect their customers are going to want to come in at the appropriate stages and get approvals before they proceed to installation.

MEMBER BLEY: I've got one question associated with that discussion that just went one, if I could get this out, any of you can address it. John Stetkar's example. The questioning of the steam generator level control system led to questions that identified acceptance criteria that need to be done. If the design's not there, those kind of questions and acceptance criteria won't come up which means when you get to the end point if all you can see is does it meet the previously determined acceptance criteria, these things can never fit in a processor. Or am I missing the boat?

MEMBER SIEBER: You're right.

MR. WILSON: I agree with you, it's not a perfect situation. That's why as a general matter we set out to get a complete design at the design certification stage. This is an accommodation that the industry requested and the Commission agreed to, and we're doing it on a case-by-case basis. It's not an ideal situation. It's an accommodation to deal with these issues of rapidly evolving technology.

MEMBER BLEY: Can your questions lead to the need for new testing or modified acceptance criteria if it looks like it's --

MR. WILSON: If we were to do that, the burden would be on the staff to justify that. That, in effect, would be a backfit.

MEMBER BLEY: So now we're into a backfit situation.

MR. WILSON: Yes.

MEMBER BLEY: Which requires a little more justification.

MR. WILSON: Yes.

MS. CUBBAGE: Right.

MEMBER BLEY: That's what I thought. Thanks.

MEMBER ARMIJO: Well, you know, it seems like our big problem is we've never built a certified design in the United States. We've certified plants, but we've never built them. But certified plants have been built in Japan.

MS. CUBBAGE: Yes.

MEMBER ARMIJO: And in --

MEMBER SIEBER: Later. Way later.

MEMBER ARMIJO: -- I guess Taiwan. It took a long time there. But maybe GEH or someone can -- you know, nobody wants to take an enormous and economic risk in building a plant that's not complete, you know fully designed. Maybe GEH or the staff knows where a certified plant has been designed, did they go through the same DAC and ITAAC process and did it lead to a lot of problems? Certainly the Japanese regulators aren't pushovers.

MR. WILSON: Let me takeover. I see your point.

MEMBER ARMIJO: This path has been followed by somebody.

MR. WILSON: No. What you're trying to do is draw an analogy to the Kashiwazaki-Kariwa plant, K6/K7. I can't pronounce it correctly in Japan. And that's a version of the ABWR design that was licensed under a process that they used in Japan that's similar to our construction permit operating license. And they were building that plant and finishing the design as they were constructing it in a manner in which they've done it in the past.

Now the version that we certified as the U.S. ABWR design, which has some differences from that design. And as part of doing that certification, GE requested and the Commission approved use of DAC in certain areas.

So if you're saying is there any analogy to somebody else in the world building a plant with that sort of design approval? And the answer is no. The first time is going to be South Texas.

MR. ASHCRAF: I just wanted to add that when she talked about documentation and so forth, you know we have to get back to the life cycle process. And you know throughout that process there'll be thousands and thousands of documents. And they can't progress until they go through each phase.

Now they have the ability to loop back if they run into problems, et cetera. But that's one of the things that we're trying to tie into is their process as they're going through the life cycle stage so that we can review and identify issues at that point. But, you know, what we have approved so far as the plan which specifies how they're going to do things and what requirements they're going to met, et cetera. And so at any point they not following the plan, then that's an issue.

MR. OESTERIE: One of the methods that GEH proposed in their Appendix 14.3A on DAC closure was a process or using the topical report process to provide the designs to close out DAC. And that is similar to the process that Westinghouse used on the AP-1000. They had a WCAP for the design process for digital control system. And os that process also allows the staff to ask RAIs to ensure that their concerns are resolved prior to approval of that topical report.

So it just follows a different review path than the DCD has a whole. But the DCD can reference those topical reports and more importantly, the COL applicant's referencing the DCD can reference those topical reports for approved designs if the staff reviews those and approves them.

MEMBER STETKAR: Eric, since you're educating us on this process here, is there anything in the process in the regulations or the policy documents that specifies -- apparently there isn't, I guess this is a rhetorical question. But I would like to understand why.

When the DAC closeout needs to be completed? In other words, I was surprised a bit to learn that GEH proposed final closeout of the DAC after the COL and before fuel load, naturally. And that there seemed to have been some discussion about well there isn't very close guidance on this, but the staff agreed with that kind of timing.

Is there any way -- I mean are the regulations written such that that latitude is necessary or could you have taken a harder line and said no, in particular for things like digital I&C and piping systems and human factors, those DAC shall be closed out before the COL issuance? That would avoid this fact of having something built and installed and then raising possible backfit concerns.

MR. OESTERIE: Currently the regulations aren't that prescriptive. Since DAC our part of ITAAC and the regulations specifies that it has to be closed out prior to fuel load.

MEMBER STETKAR: Okay.

MR. OESTERIE: Now I'm sure Jerry can provide the background and the basis for why the staff didn't choose something else for DAC and why the Commission didn't approve that. But in terms of DAC closure for the ESBWR, we are working with GEH and the COL applicants referencing the ESBWR design to provide us -- well, let me back up.

GEH has put in a COL action item in their DCD for the COL applicant to provide the staff with their DAC closure schedule.

MEMBER STETKAR: That's the schedule?

MR. OESTERIE: The schedule, right. But it gives us a little bit more than what the regulation requires in terms of timing and making sure that we have the resources available to review their completed designed prior to the designs getting installed. And that is the intent that the staff came to the COL applicants and GEH with is that we want to make sure that the schedule that they provide us is such that we can review those completed designs before they get installed.

We understand the regulations, they don't have to do that. But like Jerry said, it's a trade-off. If they don't let us look at the designs and they just go ahead and put it in without our approval, the risk rises.

MEMBER STETKAR: But on the other hand, I think I understood you to say that if you raise a concern about the design after the COL is issued and, indeed, the equipment is installed in the plant, then the bar is raised for the staff because you have to justify that concern as a backfit?

MS. CUBBAGE: No, no.

MEMBER STETKAR: Oh? Okay.

MR. WILSON: We're measuring it against the design acceptance criteria. So let's assume there are two options here.

Option one, they didn't meet the design acceptance criteria. We're going to tell them they didn't meet it, they're going to have to redo the design.

MEMBER STETKAR: Okay.

MR. WILSON: Option two, they met the design acceptance criteria but some other issue came up that we had not previously accounted for in the design acceptance criteria. Now we want to apply some new requirement to them or forcing it. Now we're talking backfit.

MEMBER STETKAR: Yes.

MEMBER SIEBER: This is all a matter

of--

MEMBER STETKAR: So how the design acceptance criteria are written --

MR. WILSON: Is very important.

MEMBER STETKAR: -- is very, very important.

MR. WILSON: Mr. Chairman --

MR. OESTERIE: And we have some examples later in the presentation.

CHAIRMAN CORRADINI: Go ahead expeditiously.

MR. OESTERIE: Expeditiously.

CHAIRMAN CORRADINI: This is useful. I'd like to hear it, but --

MR. OESTERIE: This is why we wanted to do this before we got into the presentation of 14.3

MEMBER SIEBER: We'll move ahead anyway.

MR. OESTERIE: So let's go to slide 7.

We went to Tier 1 after Tier 2 because Tier 1, again, just one volume of information is what the NRC will certify. And that means any changes to it have to be reviewed or approved by the NRC.

Tier 1 information is derived from the Tier 2 information. So it includes definitions and general provisions. It includes the design descriptions. It includes the inspections, tests, analyses, and acceptance criteria of the ITAAC. It includes the significant site parameters that the COL applicant has to meet. And significant site interface requirements.

One of the rules of thumb that we go by is that there cannot be any new design information in Tier 1 that's not already in Tier 2. Because Tier 2 describes the design of the plant and Tier 1 includes the ITAAC and these other things.

If Tier 2 gets approved, Tier 1 gets certified. And the Tier 1portion of the document is what gets rolled into the design certification rule in the appendixes of Part 52.

CHAIRMAN CORRADINI: Can you repeat what you just said.

MR. OESTERIE: Tier 2 gets approved, Tier 1 gets certified. Certification means that --

CHAIRMAN CORRADINI: So it's at that high level that it's actually --

MR. OESTERIE: Yes. And that's one of the ways that the NRC --

MEMBER SHACK: But go back to that statement you said, which one couldn't introduce anything new?

MEMBER STETKAR: Tier 1.

MEMBER SHACK: Tier 1.

MR. OESTERIE: Well, Tier 1 cannot have any design information in it that's not already in Tier 2. Because Tier 1 and the ITAAC, specifically the ITAAC, is really a verification program. The program to verify that the things that you described in Tier 2 will function as designed --

MEMBER SHACK: Because it was certified, I sort of picked Tier 1 as the higher level description. But I can really sort or see it's the [part that you've plucked out of Tier 2 and frozen, yes.

MR. OESTERIE: The important stuff.

MS. CUBBAGE: Yes.

MEMBER BROWN: Say that again. Tier 1 is certified and Tier 2 is?

MR. OESTERIE: Tier 1 is certified, tier 2 is approved.

MEMBER BROWN: I don't appreciate the difference. It's a change of rule.

MR. OESTERIE: One goes into 10 CFR 50--

MEMBER STETKAR: Tier 1 is part of the rule.

MR. OESTERIE: Part of the rule, yes.

CHAIRMAN CORRADINI: Everything else is--

MR. WILSON: Well let's be careful. It's all --

CONSULTANT WILLIS: Could you explain this to a member of the public?

MR. OESTERIE: Yes, not successfully.

CHAIRMAN CORRADINI: Jerry, you had a comment?

MR. WILSON: Yes. It's all incorporated into the rule. The important distinction is the change process, which is quite complicated. But the easy way to understand it is it's much harder to change Tier 1 information than it is to change Tier 2 information.

MEMBER SHACK: And Tier 2 on his slide it says 50.59-like process.

MR. WILSON: That's correct.

MEMBER SHACK: Is it really much in the licensee's hands as 50.59 is?

MR. WILSON: Yes. In fact, when we did the update to Part 52 we adopted the updated version of 50.59 and that's in the Tier 2 change process.

MS. CUBBAGE: But that's only a plant-specific basis. You can't change the generic DCD under the 50.59 process.

MR. OESTERIE: Okay. So we mentioned that Tier 1 -- changes to and departures from Tier 1 information require NRC approval and are governed by processes in Section VIII.A of the design certification rule. So when a COL applicant references a DCD and there are some changes that they want to make to Tier 1 information, they have to include in their application a request for departure.

MS. CUBBAGE: And it is an exemption.

MR. OESTERIE: Yes. And it is an exemption from the rule. Right.

MEMBER SIEBER: All right.

MR. OESTERIE: From a design certification rule.

So let's move on Tier 2 star. Tier 2 star is also subject to a change process. And I believe it's the same change process as Tier 2. However, Tier 2 star information is a little bit different, and I gave you some examples of Tier 2 star information from the ABWR design certification rule and the AP-1000 design certification rule. And that they are things that the design is based on, important parameters are based on but we do expect to change through the life of the plant. Like the fuel designs may change, but we want that to be controlled.

MEMBER ARMIJO: But you get topical reports on a new fuel design and you'd review and approve that?

MR. OESTERIE: Yes. Right. And to complicate matters even further, if we go to the next slide there's another type of Tier 2 information that we felt was necessary to control, but it has a Sunset clause on it. Because we understand that licensees may want to during the life of their operation adopt new code cases or there will be updates to ASME Code Section III. So this set of Tier 2 startup information which is also called specifically in the design certification rule has a Sunset clause on it and it reverts to regular Tier 2 information where you applied the 50.59 process to after the plant first achieves full power.

MEMBER ARMIJO: And after that all of this is off the table then?

MR. OESTERIE: Yes. After that all of that information reverts to regular Tier 2 information.

Next slide, please.

Now let's get --

MS. CUBBAGE: You looked puzzled on that. And I think the reason for the Sunsetting is those are major things that are not expected to change after you've achieved first full power.

MR. OESTERIE: Correct.

MS. CUBBAGE: They were like, you know -- you're not going to decide you're going to have a different structural dimension. You've built the plant.

MR. OESTERIE: Yes.

MEMBER SHACK: Redesign your containment.

MS. CUBBAGE: Yes, exactly. Those are the type of things the Tier 2 star, the reason for it to be Tier 2 star goes away once you've finished construction.

MR. OESTERIE: Yes. Thanks for the clarification, Amy. I really focused on the one thing that were the very limited aspects of this that could change.

So ITAAC is a verification program. It doesn't include any new information.

There are very limited design completion aspects to ITAAC. And they include the design acceptance criteria. Very limited areas. There's also another special type of ITAAC associated with DRAP, the Design Reliability Assurance Program.

CHAIRMAN CORRADINI: So if I might just -- again, I'm doing this for educational purposes.

For if there weren't a DAC, the ITAAC program is a regularized program that you would necessarily go through even under 10 CFR 50 in terms of inspection, testing and analyses? I mean, you had two licenses at that time. You had legal proceedings that are different, but in terms of how you handed it off from the design to what you construct it to what you inspect it to say go ahead and load full, the ITAAC is a regularized version of that?

MR. OESTERIE: Based on my understanding, that sounds correct.

CHAIRMAN CORRADINI: Okay. All right.

MR. WILSON: You will always have ITAAC.

MR. OESTERIE: Or something like it. Under the Part 50 process of what is called ITAAC, but we did the same thing --

MEMBER BROWN: It's the same thing, it's

a test program.

MR. OESTERIE: Exactly.

CHAIRMAN CORRADINI: That I want to make sure of.

MS. CUBBAGE: Then you had to be accomplished, but this provides the specificity and the up front agreement on what's going to be verified and what the acceptance criteria are.

CHAIRMAN CORRADINI: Taking the legal out of it from an engineering standpoint if I took the DAC out of it, it's the logical thing you'd have to do to make sure what you built is what you promised to built and that it works like you think it's going to work?

MEMBER STETKAR: And its specified up front so there are no surprises.

MEMBER BROWN: Yes. Right. And DAC just says you don't have to specify for these things up front. We'll decide ten years later and nobody gets to look at them.

MR. OESTERIE: And completing the ITAAC is designed to show that the plant has been constructed and will operate in accordance with its license.

CHAIRMAN CORRADINI: Okay.

MR. OESTERIE: So it's verification of the as-built as installed condition of the plant. Like I said before, no new design information can be in Tier 1, it must all be in Tier 2. Tier 2 can however provide supplemental information on how the inspection, test analyses are to be performed to satisfy the acceptance criteria.

What might be contained in the reports that are specified by the acceptance area.

The next three bullets really talk about the format of the ITAAC. The first column you have a design requirement and the second column you have either an inspection, test or analyses or a combination of those three that the licensee will use to demonstrate that the design requirement has been met. And there are objective and verifiable acceptance criteria for these inspection, tests and analyses.

Next slide, please.

Again, the goal for these three items, the design requirements inspection, tests, analyses and acceptance criteria that they be objective and variable.

The ITAAC primarily have been written based on a structure system and component basis.

But that is not required. That has just been prudent and practical from a standpoint of trying to obtain design certification.

COL's have the responsibility. COL applicants have the responsibility to successfully complete the ITAAC. I'm sorry I misspoke. Not the applicants, it is the licensees. Okay. The combined licensees have the responsibility to successfully complete the ITAAC. Notify NRC of that completion. And provide adequate documentation for NRC verification.

The staff is currently in discussions with the NEI and utility representatives on the ITAAC verification process and what the requirements need to be and what the expectations are for providing us with sufficient documentation in these ITAAC closeout letters for us to review.

The regulations on that item are in 52.99.

The NRC also has a requirement to either inspect or audit completion of ITAAC. In addition, the NRC has the responsibility to provide notice in the *Federal Register* of their verification of ITAAC completion.

Lastly, there is a requirement that the

Commission confirm or approve startup of a plant only after all ITAAC have been successfully completed. And that regulation is 52.103(g)

CONSULTANT WILLIS: How much of this is available to the public? I mean you got this *Federal Register* notice, but do you have anything to back it up in the form of all these documents being available and some document rule or something?

MR. OESTERIE: I think the discussions on what's going to be available to back up the *Federal Register* notice, I haven't been part of those. So I'm not sure what the outcome of those discussions have been. I'm sure there will be something.

Jerry, do you have any statement?

MR. WILSON: I missed the first part of the question. What was?

CONSULTANT KRESS: It seems like the only reason for *Federal Register* notice is to let the public know what you're doing.

MR. WILSON: That's correct.

CONSULTANT WILLIS: Right.

CONSULTANT KRESS: And so we were wondering what information --

CONSULTANT WILLIS: To back it up.

CONSULTANT KRESS: -- to back it up? Would there be references? Would there be tables?

CONSULTANT WILLIS: Will it actually be tables like this?

MR. WILSON: Well that information is already public, the tables you're looking at. Now, the licensees are going to send in letters giving their basis for claiming that each particular ITAAC is met. And as Eric said, we're working with industry on what's in those letters. But as you understand it, underneath that are their inspection reports and a lot of other more detailed information. And that really detailed information would not be available unless some particular party was involved in a hearing and could access it that way.

CONSULTANT WILLIS: Some particular body from the public had an issue with some particular ITAAC, could that person follow the paper trail and figure out what happened?

MR. WILSON: If they had inside information.

MR. OESTERIE: Under 52.103 there is a request for notification for request of hearing or an opportunity for hearing on whether or not the

ITAAC had been successfully completed.

The hurdles that any interested party that files in accordance with that or to contest whether or not ITAAC had been successfully completed are higher than the other hearings. They have to have prima facie evidence of the ITAAC not being successfully completed. And that's why Jerry mentioned they really have to have some insider information.

CONSULTANT WILLIS: Right.

MR. OESTERIE: So there is an opportunity. It's the last opportunity that the public has to intervene in the process prior to the Commission making their finding of 52.103(g)

MEMBER SIEBER: So you have to have a basis that state that the ITAAC hasn't been met?

MR. OESTERIE: Correct.

MEMBER SIEBER: This is an SLB kind of matter, right?

MR. OESTERIE: Yes.

MEMBER SIEBER: And so you have to present the proof beforehand, right? You have to have standing?

MR. OESTERIE: Right.

So on the next slide, just some examples of ITAAC from the ESBWR DCD.

The first one is a functional arrangement ITAAC where you inspect inspection of the as-built system will be performed and make sure it matches up with the general layout of the system as provided in the Tier 1 design description. And acceptance criteria reflects that.

The second item talks about pressure boundary welds and piping identified in the specific meeting ASME Code Section III requirements. And those are pretty specific.

The next one is on pressure boundary integrity and the testing of the hydrostatic testing.

The last one is a very specific example on throat diameter of each main steam line flow restrictor. And the acceptance criteria is very objective and verifiable.

So if we could go on to the next slide.

And here's our favorite discussion topic, DAC. And I think we've covered most of this already.

CHAIRMAN CORRADINI: Yes, we have.

MR. OESTERIE: Thank you. And so we're going to move on.

CHAIRMAN CORRADINI: Yes, we can. Yes, we can.

MR. OESTERIE: To the next slide.

CONSULTANT WILLIS: So pipe stress analyses are rapidly changing technology?

MR. OESTERIE: Well, there are various opinions on that. However, that was approved by the Commission on several --

MS. CUBBAGE: The basis.

MR. OESTERIE: That was the basis on several design certifications. It was the as-built reconciliation with the design.

MS. CUBBAGE: Rapidly evolving wasn't the basis for that.

MR. OESTERIE: Right.

So design acceptance criteria. DAC are a set of prescribed limits and parameters, procedures and attributes upon which the NRC relies in a limited number of technical areas in making a final safety determination to support design certification. And as I mentioned before, Westinghouse had provided a W cap as part of their design certification application to document that process, which the staff reviewed and approved.

The goal for DAC are that they be

objective; measurable, testable, or subject to analysis using pre-approved methods.

DAC must be verified as part of the ITAAC performed to demonstrate that the as-built facility conforms to the certified design.

So just to make clear to everyone, DAC is part of ITAAC, part of the ITAAC program. I know there's been some confusion about for specific systems where does the DAC stop and where does the ITAAC start. Well, it's really where do you complete the design and where do you start the verification of that design is a better description of that differentiation.

The DAC are incorporated by reference by COL referencing a design --

MEMBER SHACK: But you treat them differently in the review process.

MEMBER SIEBER: But every DAC has an ITAAC?

MR. OESTERIE: Yes. Every DAC has an ITAAC.

MEMBER SIEBER: So it doesn't make any difference.

MR. OESTERIE: Yes.

MEMBER SHACK: But every ITAAC does not

have a DAC?

MR. OESTERIE: That's correct.

MEMBER SHACK: I mean, you said you were going to be reviewing the DAC whereas you're more or less going to be auditing the ITAAC, at least that was the impression I got.

MR. OESTERIE: Well, the ITAAC are already provided in the design certification application. And that's --

MEMBER SHACK: No, but I mean the completion. I'm sorry.

MR. OESTERIE: The completion. Yes. There is what we call we do a sample inspection of those ITAAC.

MEMBER SHACK: Right. But you won't be sampling the DAC? You will be reviewing all the DAC?

MR. OESTERIE: Correct. Correct.

MEMBER STETKAR: Ask a specific example. Because I've got it highlighted here.

There's something in the DAC. I assume it's DAC, it says design acceptance criteria. It says there needs to be a list of minimum inventory of alarms, displays and controls.

MR. OESTERIE: Yes.

MS. CUBBAGE: You picked a good one.

MEMBER STETKAR: Well, you know. It took me a while to find one, but this is objective.

CHAIRMAN CORRADINI: We can always count on you to find a good one.

MEMBER STETKAR: I want to understand the process.

MEMBER SHACK: What's the minimum?

MEMBER STETKAR: Because the requirement is that there shall be a list of the minimum inventory of alarms, displays and controls. And the acceptance criteria is that there is a list of minimum inventory of alarms, displays and controls. What are those and where does the review -- this gets back to the review versus audit. Where does the review process say okay, I need level that goes between X and Y and I need temperature that goes between A and B, and I need pressure that goes between W and R.

MS. CUBBAGE: I'll take this one.

MEMBER STETKAR: And I understand the ITAAC would then say ah, indeed, in the control room there's those levels and pressures and temperatures and they go between those various limits.

MS. CUBBAGE: The development of the

minimum inventory list, GEH has provided us with a process for that involving looking at the EPGs, look at risk-significant operator actions.

CHAIRMAN CORRADINI: The what? Looking at what?

MS. CUBBAGE: EPS, emergency procedure guidelines, the generic EOPs. And also looking at RG 1.97, et cetera, et cetera. But we have new regulatory guidance that's come out which will likely lead to GE providing us the minimum inventory list as part of the certification rather than as they've proposed.

This has been an open item for some time with the staff.

CHAIRMAN CORRADINI: What changed, though? You said something in the middle that due to new regulations.

MS. CUBBAGE: Regulatory guidance is affirming previous Commission policy that we need the minimum inventory list as part of the certification. And so --

MEMBER STETKAR: An actual list, not a process?

MS. CUBBAGE: The actual list, not just the process. And that has been an open item for a long time.

CHAIRMAN CORRADINI: Where is it? Is it in Chapter --

MS. CUBBAGE: The open item is in Chapter 7. And this is an evolving issue.

MEMBER STETKAR: I thought it would be under the ITAAC or DAC because that's --

MR. DAHLGREN: It's in Chapter 18.

MS. CUBBAGE: It's in 18.

MR. DAHLGREN: It's in 18.

MS. CUBBAGE: It's in 18, okay. The actual -- yes, the actual -- well, it crosses over both of these areas.

MEMBER STETKAR: Never mind. It was an example.

MS. CUBBAGE: You want to find another one? But we've been unhappy with that for some time. So I just wanted to assure you of that.

MR. OESTERIE: The last bullet just points out the flexibility and from the process that DAC may be closed out prior to or following COL issuance, but it shall be closed out prior to fuel load as part of ITAAC.

The next three slides really just provide examples of DAC that I pulled from the ESBWR

DCD that are related to human factors engineering. And that was probably the best example.

MEMBER STETKAR: As I saw it, essentially all of the digital I&C stuff in terms of DAC seem to have been folded into the human factors. If I read through things, they all tend to fold down and say see Section 3.2, see Section 3.3.

MR. OESTERIE: Through INC and HFE are very closely related.

And that's the end of my presentation. I even included a slide at the end for discussion and questions. But I think we've been overtaken--

CHAIRMAN CORRADINI: Well we think we did our best as a class to ask that.

CONSULTANT WILLIS: I just wanted to -- I'm just 19ooking at this. Some of these acceptance criteria may be rather wishy-washy. The design commitment is that something exists and then acceptance criteria, well it exists and has some sort of general properties. But, you know, are these tough acceptance of criteria?

MR. OESTERIE: I don't know that they're really tough. This area is --

CHAIRMAN CORRADINI: You can't answer that.

CONSULTANT WILLIS: Well, I'm used to acceptance criteria like 2200 degrees.

MR. OESTERIE: The INC and the HFE is really on the edges of my knowledge.

CHAIRMAN CORRADINI: That's why we were hoping originally to have seven with this so you guys could have more fun with the Chapter 7 people. But alas we failed you.

MEMBER BROWN: The results of the confirmation of the as-built procedures and entraining design implementation concluding that human engineering discrepancies resulting from adopt sections, if any, are resolved. That's an acceptance criteria.

CONSULTANT WILLIS: Is that really good enough?

MR. WACHOWIAK: And that acceptance criteria comes right out of NUREG 04 --

MEMBER BROWN: I don't care where it comes from --

MR. WACHOWIAK: --0711 that told us how we're supposed to do the HFE process.

MEMBER SHACK: This is HFE now. I mean, you know it's going to be tough to write --

MEMBER STETKAR: Except for the fact

that a lot of the digital I&C stuff, you don't see acceptance criteria for the digital I&C as a system by itself. You know, it's folded into the HFE. In the software exactly.

MEMBER SIEBER: If it works --

MEMBER SHACK: It's either for the -- or the ASME code and --

MEMBER STETKAR: Well, or where you say acceptances that one example you had there where you're supposed to have whatever it was. So many millimeters diameter or something.

CHAIRMAN CORRADINI: Other questions from the members?

All right. Thank you very much. Thank you very much.

To remind us all for tomorrow we're now going to enter into the world of, after learning about ITAACs, we're going to enter into the ITAAC world tomorrow.

MEMBER STETKAR: Unfortunately, we will forget what we heard today.

MR. OESTERIE: Yes. Tomorrow GEH will present their Tier 2 Section 14.3, their selection criteria methodology for taking Tier 2 information and putting it in Tier 1.

CHAIRMAN CORRADINI: Okay.

MR. OESTERIE: And following that the staff will present their review of -- their Tier 1. And following that the staff will present the review of --

CHAIRMAN CORRADINI: The organization of it.

All right.

(Whereupon, at 5:09 p.m. the hearing was adjourned until tomorrow at 8:30 a.m.)

# CERTIFICATE

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of:

Name of Proceeding: Advisory Committee on Reactor Safeguards

Docket Number: n/a

Location: Rockville, MD

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and, thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings.

Eric Hendrixson
Official Reporter
Neal R. Gross & Co., Inc.

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

# Presentation to the ACRS Subcommittee

# Overview of the use of Tier 1, Tier 2, Tier 2*, ITAAC and DAC in Design Certifications

**Presented By: Eric Oesterle**
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October 21, 2008

## Overview of the use of Tier 1, Tier 2, Tier 2*, ITAAC and DAC in Design Certifications

## Purpose

- Provide an overview and historical perspective on the use of Tier 1, Tier 2, Tier 2*, ITAAC and DAC for design certifications to support the follow-on presentations:
  - ESBWR DCD Tier 2, Section 14.3, ITAAC from GEH
  - ESBWR DCD Tier 1 from GEH
  - NRC staff review of ESBWR DCD Tier 2, Section 14.3
  - NRC staff review of ESBWR DCD Tier 1

- Answer Subcommittee's questions

# Overview of the use of Tier 1, Tier 2, Tier 2*, ITAAC and DAC in Design Certifications

## Commission guidance:

- **SECY 90-377**: requirements for design certification under 10 CFR Part 52 (level of design detail)
- **SECY 91-178**: inspections, tests, analyses, and acceptance criteria (ITAAC) for design certifications and combined licenses
- **SECY 91-210**: inspections, tests, analyses, and acceptance criteria (ITAAC) requirements for design review and issuance of a final design approval (FDA)
- **SECY 92-053**: use of design acceptance criteria during 10 CFR Part 52 design certification reviews
- **SECY 92-214**: development of inspections, test, analyses, and acceptance criteria (ITAAC) for design certifications (ABWR and System 80+)

# Overview of the use of Tier 1, Tier 2, Tier 2*, ITAAC and DAC in Design Certifications

## Regulations:

### Design certification applications - 10 CFR 52.47(b)(1): for DC only

"The application must also contain the proposed inspections, tests, analyses, and acceptance criteria that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, a facility that incorporates the design certification has been constructed and will be operated in conformity with the design certification, the provisions of the Act, and the Commission's rules and regulations..."

### Combined License applications - 10 CFR 52.80(a): for entire facility

"The application must contain the proposed inspections, tests, analyses, including those applicable to emergency planning, that the licensee shall perform, and the acceptance criteria that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, the facility has been constructed and will be operated in conformity with the combined license, the provisions of the Act, and the Commission's rules and regulations."

# Overview of the use of Tier 1, Tier 2, Tier 2*, ITAAC and DAC in Design Certifications

**Regulatory guidance:**

- Standard Review Plan 14.3, Inspections, Tests, Analyses and Acceptance Criteria (ITAAC) - Draft Rev. 0, April 1996

  - March 2007
- Regulatory Guide 1.206, Combined License Applications for Nuclear Power Plants
  - Section C.II.1, Inspections, Tests, Analyses, and Acceptance Criteria
  - Section C.III.5, Design Acceptance Criteria
  - Section C.III.7, Inspections, Tests, Analyses, and Acceptance Criteria for Combined License Applications referencing a Certified Design and/or Early Site Permit

# Overview of the use of Tier 1, Tier 2, Tier 2*, ITAAC and DAC in Design Certifications

## Tier 2 - defined in Section II of design certification rule(s)

"means the portion of the design-related information contained in the generic DCD that is approved but not certified by this appendix (Tier 2 information). Compliance with Tier 2 is required, but generic changes to and plant-specific departures from Tier 2 are governed by Section VIII of this appendix. Compliance with Tier 2 provides a sufficient , but not the only acceptable, method for complying with Tier 1. Compliance methods differing from Tier 2 must satisfy the change process in Section VIII of this appendix...Tier 2 information includes:

1. Information required by §§52.47(a) and §§52.47(c), with the exception of generic technical specifications and conceptual design information;
2. Supporting information on the inspections, tests, and analyses that will be performed to demonstrate that the acceptance criteria in the ITAAC have been met, and;
3. Combined license (COL) action items (COL license information), which identify certain matters that must be addressed in the site-specific portion of the final safety analysis report (FSAR) by an applicant who references this appendix. These constitute information requirements but are not the only acceptable set of information in the FSAR. An applicant may depart from or omit these items, provided that the departure or omission is identified and justified in the FSAR. After issuance of a construction permit or COL, these items are not requirements for the licensee unless such items are restated in the FSAR.

*Changes to or departures from Tier 2 information are governed by the processes in Section VIII.B of the DCR and may require prior NRC approval ("50.59-like process")

# Overview of the use of Tier 1, Tier 2, Tier 2*, ITAAC and DAC in Design Certifications

## Tier 1 - defined in Section II of design certification rule(s)

"means the portion of the design-related information contained in the generic DCD that is approved and certified by this appendix (hereinafter Tier 1 information). The design descriptions, interface requirements, and site parameters are *derived from Tier 2 information*. Tier 1 information includes:

1. Definitions and general provisions;
2. Design descriptions;
3. Inspections, tests, analyses, and acceptance criteria (ITAAC);
4. Significant site parameters; and
5. Significant site interface requirements"

*Changes to and Departures from Tier 1 information require NRC approval and are governed by the processes in Section VIII.A of the DCR

# Overview of the use of Tier 1, Tier 2, Tier 2*, ITAAC and DAC in Design Certifications

## Tier 2*- defined in Section II of design certification rule(s)

"means the portion of the Tier 2 information, designated as such in the generic DCD, which is subject to the change process in Section VIII.B.6 of this appendix. This designation expires for some Tier 2* information under Section VIII.B.6"

Examples of Tier 2* information (from ABWR DCR) that require NRC approval to change (50.90):

1. Fuel burn-up limit
2. Fuel design evaluation
3. Fuel licensing acceptance criteria

Examples of Tier 2* information (from AP1000 DCR) that require NRC approval to change (50.90):

1. Maximum fuel rod average burn-up
2. Fuel principal design requirements
3. Fuel criteria evaluation process
4. Fire areas
5. Human factors engineering
6. Small-break LOCA analysis methodology

# Overview of the use of Tier 1, Tier 2, Tier 2*, ITAAC and DAC in Design Certifications

Examples of Tier 2* information that may only be changed after plant first achieves full power following the finding required by 10 CFR 52.103(g). After the plant first achieves full power, the following Tier 2* matters revert to Tier 2 status and are thereafter subject to the departure provisions in paragraph B.5 of this section:

1. Nuclear Island structural dimensions
2. ASME Boiler & Pressure Vessel Code, Section III, and Code Case-284
3. Design summary of Critical Sections
4. ACI 318, ACI 349, ANSI/AISC-690, and AISI "Specification for the Design of Cold Formed Steel Structural Members, Part 1 and 2," 1996 Edition and 2000 Supplement
5. Definition of critical locations and thicknesses
6. Seismic qualification methods and standards
7. Nuclear design of fuel and reactivity control system, except burnup limit
8. Motor-operated and power-operated valves
9. Instrumentation and control system design processes, methods, and standards
10. Passive residual heat removal (PRHR) natural circulation test (first plant only)
11. Automatic depressurization system (ADS) and core makeup tank (CMT) verification tests (first three plants only)
12. Polar crane parked orientation
13. Piping design acceptance criteria
14. Containment vessel design parameters

## Overview of the use of Tier 1, Tier 2, Tier 2*, ITAAC and DAC in Design Certifications

ITAAC is a Verification Program

- (with very limited design completion aspects - DAC)
- Verification of as-built/as-installed condition
- No new design information can be in Tier 1, it must all be in Tier 2
- Tier 2 can provide supplementation information on how ITA are to be performed to satisfy AC
- Design requirement
- ITA
- Acceptance criteria - objective and verifiable

# Overview of the use of Tier 1, Tier 2, Tier 2*, ITAAC and DAC in Design Certifications

## Inspections, Tests, Analyses, and Acceptance Criteria

- Design requirement, ITA, Acceptance criteria - objective and verifiable
- Primarily written on structure, system, component basis but this basis is not required
- COLs have the responsibility to successfully complete the ITAAC, notify NRC of completion, and provide adequate documentation for NRC verification
- NRC inspection and/or audit
- NRC has the responsibility to provide notice in the Federal Register of their verification of ITAAC completion

# Overview of the use of Tier 1, Tier 2, Tier 2*, ITAAC and DAC in Design Certifications

| Design Commitment | Inspections, Tests, Analyses | Acceptance Criteria |
|---|---|---|
| The functional arrangement of the NBS is as described in the Design Description of this Subsection 2.1.2, Tables 2.1.2-1 and 2.1.2-2, and Figures 2.1.2-1, 2.1.2-2, and 2.1.2-3. | Inspection of the as-built system will be performed. | Report(s) document that the as-built NBS conforms to the functional arrangement described in the Design Description of this Subsection 2.1.2, Tables 2.1.2-1 and 2.1.2-2, and Figures 2.1.2-1, 2.1.2-2, and 2.1.2-3. For components and piping identified in Table 2.1.2-1 as ASME Code Section III, this report is an ASME Code report. |
| Pressure boundary welds in piping identified in Table 2.1.2-1 as ASME Code Section III meet ASME Code Section III requirements. | Inspection of the as-built pressure boundary weld will be performed in accordance with the ASME Code Section III. | An ASME Code Report exists and concludes that the ASME Code Section III requirements are met for non-destructive examination of pressure boundary welds in the NBS. |
| The piping identified in Table 2.1.2-1 as ASME Code Section III retains its pressure boundary integrity at its design pressure. | A hydrostatic test will be conducted on the code piping of the NBS required to be hydrostatically tested by the ASME Code. | An ASME Code Report exists and concludes that the results of the hydrostatic test of the ASME Code piping of the NBS comply with the requirements of the ASME Code Section III. |
| The throat diameter of each MSL flow restrictor is sized for design choke flow requirements. | Inspections of each as-built MSL flow restrictor throat diameter will be performed. | Report(s) document that the throat diameter of each MSL flow restrictor is less than or equal to 355 mm (14 in.). |

# Overview of the use of Tier 1, Tier 2, Tier 2*, ITAAC and DAC in Design Certifications

## Design Acceptance Criteria (DAC):

- Concept developed during staff reviews of ABWR and System 80+ design certification applications in early 1990's
- staff identified areas where applicants were not providing design and engineering information at a level of detail customarily reviewed by the staff in reaching a safety decision
- Pipe stress analyses, radiation shielding, instrumentation and control systems, control room design details
  - rapidly changing technologies
  - no as-built information
  - no as-procured information

# Overview of the use of Tier 1, Tier 2, Tier 2*, ITAAC and DAC in Design Certifications

## Design Acceptance Criteria (DAC):

- DAC are a set of prescribed limits, parameters, procedures, and attributes upon which the NRC relies, in a limited number of technical areas, in making a final safety determination to support design certification
- DAC are to be objective (measurable, testable, or subject to analysis using pre-approved methods)
- DAC must be verified as part of the ITAAC performed to demonstrate that the as-built facility conforms to the certified design
- DAC incorporated by reference by COL referencing a design certification
- DAC may be closed out prior to or following COL issuance and shall be closed out prior to fuel load as part of ITAAC

# Overview of the use of Tier 1, Tier 2, Tier 2*, ITAAC and DAC in Design Certifications

| Design Commitment | Inspections, Tests, Analyses | Acceptance Criteria |
|---|---|---|
| Operating Experience Review (OER) is performed in accordance with the ESBWR HFE Operating Experience Review Implementation Plan. | An inspection is performed on the OER results summary report(s).<br>**{{Design Acceptance Criteria}}** | A results summary report(s) exists that concludes that the OER activity was conducted in accordance with the implementation plan and contains:<br>• The scope of the OER.<br>• The list of sources of operating experience reviewed and summary of documented results.<br>• List of risk-important Human Actions and their resolutions from predecessor plants.<br>• A description of the process for issue analysis, tracking, and review.<br>**{{Design Acceptance Criteria}}**<br>The inspections, tests, analyses, and acceptance criteria for the Human Factors Engineering process address the ESBWR safety-related systems as defined in Table 2.2.10-1 and their associated safety-related functions. |

# Overview of the use of Tier 1, Tier 2, Tier 2*, ITAAC and DAC in Design Certifications

| Design Commitment | Inspections, Tests, Analyses | Acceptance Criteria |
|---|---|---|
| Functional Requirements Analysis (FRA) is performed in accordance with the ESBWR HFE Functional Requirements Analysis Implementation Plan and Allocation of Functions (AOF) is performed in accordance with the ESBWR HFE Allocation of Functions Implementation Plan. | An inspection is performed on the FRA and AOF results summary report(s).<br>**{{Design Acceptance Criteria}}** | A results summary report(s) exists that concludes that the FRA and AOF activities were conducted in accordance with the implementation plan and contains:<br>• The scope of the FRA.<br>• Functional hierarchy for plant safety functions including the identification of Critical Safety Functions.<br>• Plant systems and configurations that support safety functions.<br>• Definitions of high-level plant functions, their support needs, and monitoring parameters.<br>• Scope of AOF.<br>• Safety functions allocations.<br>**{{Design Acceptance Criteria}}**<br>The inspections, tests, analyses, and acceptance criteria for the Human Factors Engineering process address the ESBWR safety-related systems as defined in Table 2.2.10-1 and their associated safety-related functions.*** |

# Overview of the use of Tier 1, Tier 2, Tier 2*, ITAAC and DAC in Design Certifications

| Design Commitment | Inspections, Tests, Analyses | Acceptance Criteria |
|---|---|---|
| Design Implementation is performed in accordance with the ESBWR HFE Design Implementation Plan. | An inspection is performed on the Design Implementation results summary report(s). | A results summary report(s) exists that concludes that the Design Implementation activity was conducted in accordance with the implementation plan and contains:<br>• The results of the final (as-built) HIS Verification concluding that the "As-Built" HSIs and their design characteristics correspond to the HIS Requirements and that Human Engineering Discrepancies (if any) resulting from non-conformance are resolved.<br>• The results of the confirmation of the "As-Built" procedures and training design implementation concluding that Human Engineering Discrepancies resulting from adapted sections (if any) are resolved.<br>• The results of verification of HFE design not performed in the HF V&V concluding that the items in the verification list meet verification criteria and Human Engineering Discrepancies (if any) resulting from non-conformances are resolved.<br>• A description of the resolution to Human Engineering Discrepancies and Open issues in the issue tracking system (HFEITS).<br>• A summary of turnover of remaining Human Engineering Discrepancies / HFEITS issues.<br>*** |

## Overview of the use of Tier 1, Tier 2, Tier 2*, ITAAC and DAC in Design Certifications

Discussion/Committee Questions

U.S.NRC
United States Nuclear Regulatory Commission
*Protecting People and the Environment*

# Presentation to the ACRS Subcommittee

ESBWR Design Certification (DC) Review
DCD Section 14.2, Initial Test Program (ITP)

**Presented by Office of New Reactors**
October 21, 2008

# Purpose

- Brief the ACRS Subcommittee on the staff's review of the ESBWR DCD Application, Section 14.2, Initial Test Program.
- Describe ESBWR DCD Compliance with Regulations, Regulatory Guides (RG) and the Standard Review Plan (SRP).
- Summarize the Status of the DC Applicant's Resolution of RAIs, Supplemental RAIs and Combined License (COL) Items on ESBWR DCD Section 14.2, Initial Test Program.

# Review Team for ESBWR DCD Section 14.2:

- Lead PM
  - Leslie Perkins, Project Manager
- Lead Technical Reviewer
  - Francis X. Talbot, Reactor Operations Engineer
- Supporting NRO Technical Reviewers
  - Sixteen NRO Technical Reviewers provided Requests for Additional Information (RAIs) and Supplemental RAIs on the ESBWR ITP

## Initial Test Program Requirements and NRC Regulatory Guidance

- 10 CFR 50.34(b)(6)(iii) and 10 CFR 52.79(a)(28)
- Regulatory Guide 1.68, "Initial Test Programs for Light Water Cooled Nuclear Power Plants," Revision 1, March 2007
- Regulatory Guide 1.20, "Comprehensive Vibration Assessment Program for Reactor Internals During Pre-Operational and Initial Startup Testing," Revision 3, March 2007
- Regulatory Guide 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants," Revision 3, November 1978
- Regulatory Guide 1.206, C.I.XIV, "Verification Programs," Revision 0, June 2007
- NUREG-0800, Standard Review Plan 14.2, "Initial Plant Test Program Design Certification and New License Applicants" Revision 3, March 2007

## RAI Status Summary

- The NRO staff issued 98 RAIs on ESBWR DCD Section 14.2
- The DC applicant [General Electric Hitachi (GEH)] successfully resolved 93 of 98 RAIs noted above.
- The staff identified the following RAIs that the DC applicant still needs to resolve:
  - 14.2-24 S01
  - 14.2-70 S01
  - 14.2-73 S01
  - 14.2-97
  - 14.2-98

Response to RAIs 14.2-16 through 14.2-21 and Supplemental RAI 14.2-81, S01, included COL applicant and holder items in Subsection 14.2.10, "COL Information," to DCD Revision 5

## COL Applicant Items

- 14.2-1-A, Description – Initial Test Program Administration

  A description of the initial test program administration is developed and made available to the NRC by the COL Applicant (Subsection 14.2.2.1).

- 14.2-5-A, Site Specific Tests

  The COL Applicant will define any required site specific pre-operational and startup testing (Subsection 14.2-9)

# COL Holder Items

- 14.2-2-H, Startup Administration Manual

  A Startup Administration Manual is developed and made available by the COL Holder to the NRC 60 days prior to the scheduled start of the preoperational test program (Subsection 14.2.2.1).

- 14.2-3-H Test Procedures

  Approved test procedures for satisfying the commitments of this chapter is available to the NRC by the COL Holder approximately 60 days prior to their intended use for preoperational tests and not less than 60 days prior to scheduled fuel loading for power ascension tests (Subsection 14.2.2.2).

## COL Holder Items

- 14.2.4-H Test Program Schedule and Sequence

  The detailed testing schedule is generated by GEH and the COL Holder and is made available to the NRC prior to actual implementation (Subsection 14.2.7).

- 14.2-6-H Site Specific Test Procedures

  Approved test procedures satisfying the commitments of this chapter are available to the NRC approximately 60 days prior to their intended use for preoperational tests and not less than 60 days prior to scheduled fuel loading for power ascension tests (Subsection 14.2.9).

The staff found that the RAI responses were acceptable in that the COL applicant and holder items associated with the ITP are consistent with RG 1.68, RG 1.206, C.I.XIV and SRP 14.2.

- **RAI 14.2-24 (DCD Subsection 14.2.8.2.10, System Vibration Test)**

- Requested information on expansion, vibration, and dynamic effects test programs to meet RG 1.20 and RG 1.68.

- **GEH's Response to RAI 14.2-24:**

- Development of the test criteria will require consideration of the potential adverse flow effects on piping systems recommended in RG 1.20 and in SRP Sections 3.9.2 and 3.9.5.

- No exceptions requested from regulatory positions recommended in the applicable RGs.

- **Supplemental RAI 14.2-24 S01**

- Operating experience has revealed the potential for adverse flow effects from vibration caused by hydrodynamic loads and acoustic resonance. This is true for the reactor coolant, steam, and feedwater systems, including reactor internal components such as steam dryers.

- System vibration test for the piping systems discussed in DCD Tier 2, Revision 5, Section 14.2.8.2.10 does not address these potential adverse flow effects.

- The staff requested the applicant to describe the implementation of the dynamic effects test program to address potential adverse flow effects on safety-related piping and components in these systems.

- **RAI 14.2-70 (DCD Subsection 14.2.8.1.6, Safety System Logic and Control Preoperational Test)**

- The staff requested information on testing of digital instrumentation and control system functions.

- **GEH's Response to RAI 14.2-70:**

- Terms such as digital trip logic modules (i.e., signal comparator modules, voting logic units and output logic units, etc, are not called out specifically because their use and designation may vary depending on the logic platform.

- This level of detail is addressed in the detailed test procedure. The NRC will have access to the detailed preoperational tests as part of the design implementation process.

- Therefore, whether the applicant uses modules or controllers, the associated function is tested.

- On the basis of the above response and COL Holder Item14.2.2-H, NRC inspectors will review the COL holder's preoperational test procedures 60 days prior to their intended use.

- Supplemental RAI 14.2-70 S01

- The DC applicant should describe the Safety System Logic & Control (SSLC) major functions that will be tested in DCD Preoperational Test Subsection 14.2.8.1.6.

- Regardless of logic platform, the DC applicant should describe SSLC sensor calibration and testing.

- To meet RG 1.68 and SRP 14.2, the staff asked GEH to include testing of channel response time, sensor calibration and testing for the SSLC system channels and sensors.

- **RAI 14.2-73 (DCD Subsection 14.2.8.1.8, Leak Detection & Isolation System Preoperational Test)**

- The staff asked the applicant to describe Lead Detection & Isolation System (LD&IS) preoperational test interfacing functions and systems that must be available. Examples include:

  - Reactor Protection System (RPS) drywell pressure signal, or simulated
  - RPS mode switch signals
  - RPS interlocks bypassing the MSIV isolation when not in "RUN" mode

- The staff also asked GEH to describe, under the LD&IS preoperational test methods and acceptance criteria, the LD&IS component functions. These functions must be tested during the Preoperational test phase to demonstrate that the LD&IS meets its design basis.

- The staff also noted that ESBWR DCD Subsection 14.2.8.1.8 should be revised to test LD&IS to meet RG 1.68, Appendix A, Item J, Instrumentation & Control Systems, Items (1) through (25).

- **GEH's Response to RAI 14.2-73:**

- The operation of the LD&IS functional logic is demonstrated during a series of overlapping Preoperational tests.

- GEH did not believe any additional detail is required in response to this RAI because additional detail is provided in DCD Tier 1 and Tier 2, Revision 4.

- As indicated in GEH's response to RAI 14.2-73, ESBWR DCD Subsection 14.2.8.1.8 (5th and 6th bullets) performs the applicable preoperational tests requested.

- LD&IS controls, interlocks and bypasses are also verified through LD&IS ITAAC #4, DCD Tier 1 Table 2.2.12-5.

- The LD&IS and RPS controls, Interlocks and bypasses are described in DCD Tier 1 Table 2.2.12-4 and 2.2.7-3.

# • Supplemental RAI 14.2-73 S01

- On the bases of the above response and COL Holder Item14.2.2-H, NRC inspectors will review the COL holder's LD&IS and RPS detailed preoperational test procedures 60 days prior to their intended use.

- The staff requested that the DC applicant describe the major functions in DCD Preoperational Test Subsection 14.2.8.1.8, including LD&IS controls, interlocks and bypasses.

- **RAI 14.2-97 (DCD Subsection 14.2.8.2.11, Reactor Internals Vibration Test (Initial Startup-Flow-Induced Vibration Testing)**

- The test description and acceptance criteria for the reactor internals vibration test program (Initial Startup Flow Induced Vibration Testing) in ESBWR Revision 5, Section 14.2.8.2.11, are too broad and general.

- There was no reference to the GEH Licensing Topical Report NEDE-33259P, Revision 1, "Reactor Internals Flow Induced Vibration Program," that contains:

  - An item-by-item discussion of the components requiring testing during the first ESBWR startup test program, and

  - The types and locations of the sensors for monitoring flow-induced vibration (FIV) behavior.

- The staff requested revision to the test description in ESBWR Section 14.2.8.2.11 to address these concerns with initial startup flow induced vibration testing.

- **RAI 14.2-97 (DCD Subsection 14.2.8.2.11, Reactor Internals Vibration Test (Initial Startup-Flow-Induced Vibration Testing)**

- The approach to steam dryer load definition is identified as the plant-based load evaluation method, which is discussed in Licensing Topical Report NEDC-33408P, "ESBWR Steam Dryer-Plant Based Load Evaluation Methodology."

- The development of the FIV loads, as described in this report, meets 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 Licensing Topical Report NEDE-33313P, " ESBWR Steam Dryer Structural Evaluation."

- In DCD Section 14.2.8.2.11, the staff requested that the DC applicant reference information in these licensing topical reports that meet RG 1.20.

- **RAI 14.2-98 (DCD Subsection 14.2.8.1.36, AC Power Distribution System Preoperational Test)**

- DCD, Tier 2, Rev. 5, Section 14.2.8.1.36 states that "Performance shall be observed and recorded during a series of individual component and integrated system tests to demonstrate the following:

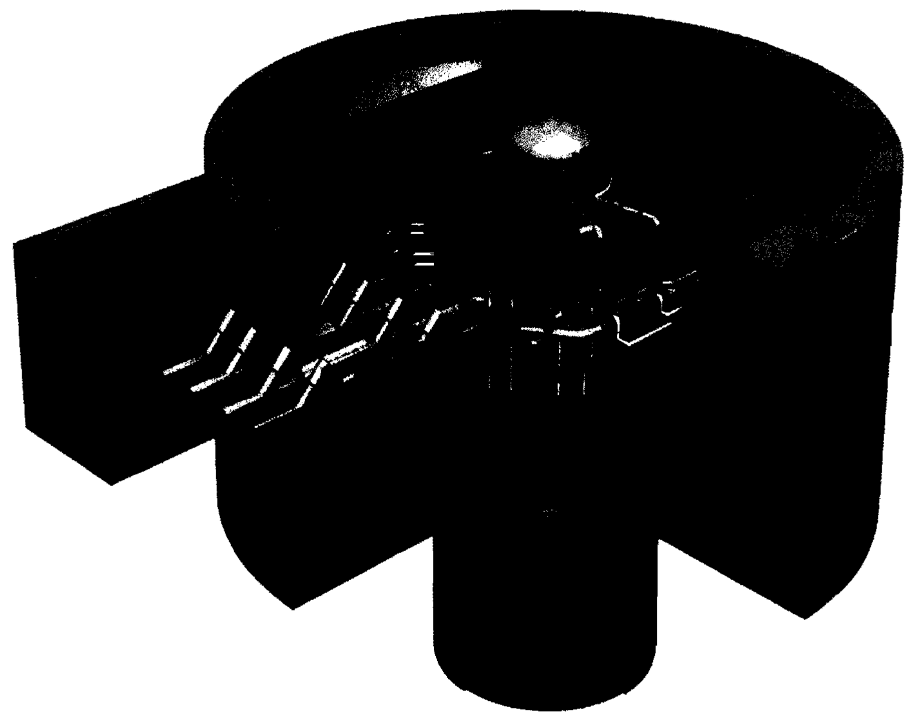
  - Proper operation of initiating, transfer, and trip devices;
  - Proper operation of relaying and logic;
  - Proper operation of equipment protective devices, including permissive and prohibit Interlocks;
  - Proper operation of instrumentation and alarms used to monitor system and equipment status;
  - Proper operation and load carrying capability of breakers, switchgear, transformers, and cables;

- **RAI 14.2-98 (DCD Subsection 14.2.8.1.36, AC Power Distribution System Preoperational Test)**
  - The capability of transfer between onsite and offsite power sources as per design;
  - The ability of emergency and vital loads to start in the proper sequence and to operate properly under simulated accident conditions; and
  - The adequacy of the plant emergency lighting system."
- The NRC staff requested that the DC applicant include the following additional items in Section 14.2.8.1.36 or provide justification for exclusion:
  - Verification of analytically derived voltage values from voltage analyses of the onsite distribution system against actual measurements (Branch Technical Position PSB 1), and
  - Proper operation of the automatic transfer capability of normal preferred power source to the alternate preferred power source is verified.

# Discussion/Subcommittee Questions ?

# ESBWR DCD Section 14.2 Initial Plant Test Program For ESBWR

**Advisory Committee on Reactor Safeguards Subcommittee on ESBWR**



Christer N. Dahlgren
Oct. 21, 2008

GE Hitachi Nuclear Energy

# Presentation Content

- Section 14.2 – Initial Plant Test Program For Final Safety Analysis Reports
  > ESBWR ITP is based on the ABWR ITP
  > RG 1.68 rev. 3
  > Preop and Startup Testing
  > First of a kind (FOAK) testing for ESBWR
- COLA Information
- Summary

# Section 14.2 - Overview

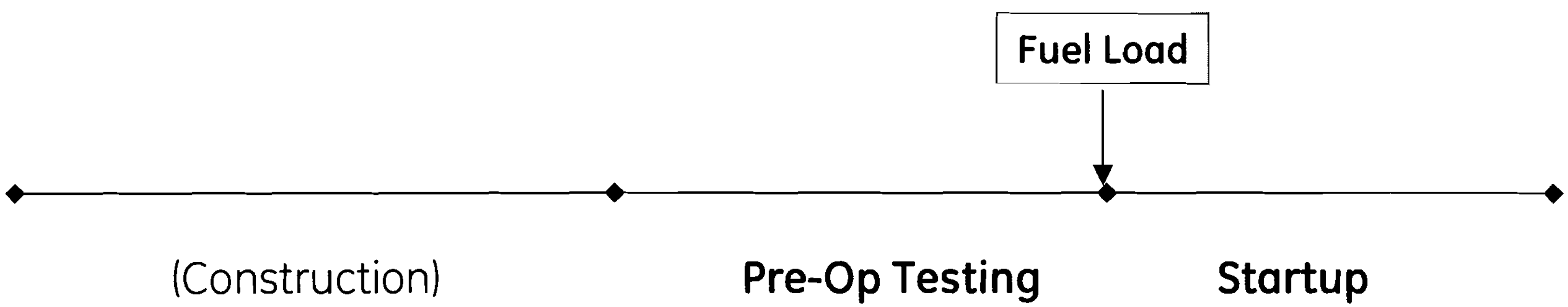
- (Section 14.1 deleted from the SRP)
- Section 14.2 includes a description of the initial test program (ITP) for the ESBWR
- Section 14.2 includes
  - > Individual TEST descriptions
    - Preop and Startup
  - > Initial test PROGRAM requirements
    - Organization and Staffing
    - Procedures

# Section 14.2 - Overview

- The content and level of detail in DCD Section 14.2 conform with the guidance in
  - NUREG-0800, Standard Review Plan, Section 14.2.
  - RG 1.68 Rev. 3 Initial Test Program for Water-Cooled Nuclear Power Plants

# Section 14.2 - Definitions

- Construction Testing
  > NOT covered in DCD section 14.2
  (per RG 1.68 Rev.3)
- Preop Testing - Before Fuel Load
- Startup Testing
  > Starts with Fuel Load
  > Ends with completion of Warranty Run



# Section 14.2 - Preop Testing

- Preop Testing Objectives (RG 1.68 Rev. 3)
  - Demonstrate SSC operability prior to Fuel Load
  - Exercise and evaluate surveillance procedures
  - Give permanent plant operating staff practical experience and OJT.
  - Individual tests described in subsection 14.2.8.1 (64 tests)

# Section 14.2 - Startup Testing

- Startup Testing Objectives:
  - > Achieve an orderly and safe initial fuel load
  - > Achieve orderly and safe initial criticality
  - > Low power physics testing
  - > Initial heatup and orderly safe power ascension
  - > Individual tests described in subsection 14.2.8.2 (34 tests)

# Section 14.2 - Startup Testing

- Five Test Plateaus:
  > Initial Fuel Loading and Open Vessel Testing

  > Testing during nuclear heatup to rated temperature and pressure (<5% power)

  > Power Operation Testing (5% - 100%) –
    - LP: 25% RTP,
    - MP: 50-75% RTP
    - Full Power: ~ 100% RTP

  > See Table 14.2-1 of the DCD Tier 2.

# Section 14.2 - Startup Testing

- **Preferred Test Plateau Sequence**
  - > Core Performance Analysis
  - > Steady State Tests (incl. vibration, thermal expansion, stability measurements)
  - > Control System Tuning
  - > System Transient Tests
  - > Major Plant Transients (including trips)
- COL 14.2-4-H requires COL holder to make startup schedule available to the NRC 60 days prior to implementation.

# Section 14.2 - ESBWR Startup

- ESBWR STARTUP PROCEDURE:
  - > Key design feature of the ESBWR design:
    - – No reactor coolant pumps
    - – No significant heat source other than Nuclear Heat.
    - – ESBWR will go critical at 80-90°C
  - > First startup – no decay heat in core.

# Section 14.2 - FOAK

- FOAK = First Of A Kind tests: (RG 1.68 section 6 of Appendix A)
  **Special tests designed to prove features unique to ESBWR:**
  > 14.2.8.2.7 Core Performance (FOAK *portion*)
  > 14.2.8.2.11 Reactor Internals Vibration (RG 1.20)
  > 14.2.8.2.35.1 Reactor Pre-Critical Heatup with RWCU/SDC in service (preop)
  > 14.2.8.2.35.2 Isolation Condenser System Heatup and Steady State Operation
  > 14.2.8.2.35.3 Power Maneuvering in the FWTOD
  > 14.2.8.2.35.4 Automatic Load Maneuvering Capability
  > 14.2.8.2.35.5 Defense-In-Depth Stability Solution Evaluation Test (OPRM monitoring and qualification)

# Section 14.2 - Non Nuclear Heatup

The ESBWR non-nuclear heatup is accomplished by operating the RWCU system in a manner to remove water from the lower region of the vessel and reject to the main condenser while the vessel is fed from a heated feedwater source.

Data collection is conducted during the nonnuclear heatup of the reactor coolant and metal temperatures.

This data will be used to verify achievement of the desired temperature to begin control rod withdrawal.

Data collection to continue during rod withdrawal and after criticality as reactor heat up is continued to the point of boiling and establishment of natural core circulation due to boiling and convection.

# Section 14.2 - Core Performance FOAK

A First Of A Kind (FOAK) test will be conducted for observation of reactor stability.

The objective of this test is to characterize the stability performance during power ascension.

The test will begin at 20% thermal power and the first time the reactor achieves a new 5% power increment above that point.

The test will collect pertinent LPRM data to identify stability performance characteristics and determine a decay ratio during the ascension to rated thermal power.

This data will be collected at sufficient instances to capture the development of instability pattern (if any) that may occur during in the ascent to rated thermal power.

# Section 14.2 - OPRM monitoring

The OPRM function will initially be installed and function to provide alarm functions only.

This test will be conducted during the entire first cycle of plant operation.

Algorithm is the DSSCD algorithm used in operating plants – setpoint adapted for ESBWR.

# Section 14.2 - FWTOD

The testing maneuvers the plant through the acceptable regions of the Power-Feedwater Temperature Operating Domain.

Data is taken at a number of specifically identified points on this map to ensure complete coverage of the operational area.

The data is sufficient to determine:

- The axial and radial core power distributions;
- Compliance with core thermal limits;
- Consistency with predicted core reactivity; and
- Stability and core flow versus core power.
- Operation of the reactor within the envelope of the Power-Feedwater Temperature Operating Domain is shown to be acceptable for core thermal limits and stability.

# Section 14.2 - ICS TEST

- FOAK test 14.2.8.2.35.2 ICS and Steady State Operation:
- Comprehensive ICS performance test:
  - > Vibration measurement,
  - > Steam inlet and condensate return (flow),
  - > Change in pool bulk temperature,
  - > Pool level change.

# Section 14.2 -

- **OTHER UNIQUE FEATURES TESTED**

GDCS

PCCS

HOWEVER, NOT "FOAK" –

These tests will be performed for each unit built

# Section 14.2 - OTHER UNIQUE FEATURES

- **GDCS Preop Test**
  - > Verification that the flow passages from GDCS and Suppression Pool to reactor vessel are unobstructed
  - > Verification of unobstructed flow passages to upper drywell
  - > Flow Test – Both GDCS injection and equalizing lines (also ITAAC)
  - > Test valves installed to enable testing Squib firing logic and flow rate, without firing Squib valve propellant

# Section 14.2 - PCCS TEST

Using prototype test data and as-built PCC unit information, an analysis will be performed to establish the heat removal capability of the PCC unit (also ITAAC).

PCCS steam supply, drain and vent piping is unobstructed;

PCCS condenser air flow versus differential pressure is within acceptable test limits;

Proper operation of IC/PCCS pool level control;

Verification of the system interface with Fuel and Auxiliary Pools Cooling System (FAPCS) for IC/PCCS pool cooling;.

PCCS Vent fans operate as required from the Main Control Room from normal power and from alternative power;

# Section 14.2 - Major Transient Tests

- Loss of Load/Turbine Trip testing
  - > Verify proper electrical equipment response and reactor system transient performance (including Control Rods, and Turbine Bypass Valves)
- Shutdown from outside the control room
  - > Prove ability to perform controlled S/D and C/D
- Loss of Turbine Generator and Offsite Power Test
  - > Verify proper electrical equipment response and reactor system transient performance
- Reactor Full Isolation Test – simultaneous closure of MSIVS.
  - > Proper response of the core, and equipment such as the MSIVs, ICS, the RPS, and the Feedwater System is demonstrated
- Feedwater Pump Test
  - > Prove ability to respond and continue power operation

# Section 14.2 - Procedures

- Test Procedures:
  - > Specify testing prerequisites
  - > Describe desired initial conditions
  - > Include the sequence of testing (with signature blocks and hold points)
  - > Specify acceptance criteria
  - > Specify data used for observations (i.e. test data required).
  - > Normal plant procedures to be used where practical.

# Section 14.2 - Lessons Learned

ESBWR is an evolutionary design

- GEH experience from 30 previous BWR/ABWR startup programs.
- NRC LER's, INPO correspondence and other OE applied where practical.
- ITP to be used for plant permanent personnel training, and improved system knowledge.
- ESBWR ITP built on ABWR ITP.

# Section 14.2 - COLA Information

- The COLA applicant/holder referencing the ESBWR DCD will provide:
  - > A Description of ITP Administration (COL 14.2-1-**A**)
  - > Startup Administrative Manual (COL 14.2-2-**H**)
  - > Test Procedures (COL 14.2-3-**H**)
  - > Test Program Schedule and Sequence (COL 14.2-4-**H**)
  - > Site Specific Tests (COL 14.2-5-**A**)
  - > Site Specific Test Procedures (COL 14.2-6-**H**)

# Summary

- Section 14.2 Provides Description of ESBWR Initial Test Program (ITP).
- Adheres to SRP for 14.2, and RG 1.68 Rev.3.
- Comprehensive Test Program Based on ABWR ITP.
- FOAK and Major Transient Testing described.
- Includes organizational and administrative requirements for ITP.