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UNITED STATES NUCLEAR REGULATORY COMMISSION'S

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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586TH MEETING

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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FRIDAY

SEPTEMBER 9, 2011

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ROCKVILLE, MARYLAND

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The Advisory Committee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B1, 11545 Rockville Pike, at 8:30 a.m., Said Abdel-Khalik, Chairman, presiding.

COMMITTEE MEMBERS:

SAID ABDEL-KHALIK, Chairman

J. SAM ARMIJO, Vice Chairman

JOHN W. STETKAR, Member-at-Large

SANJOY BANERJEE, Member

DENNIS C. BLEY, Member

CHARLES H. BROWN, JR., Member

MICHAEL L. CORRADINI, Member

DANA A. POWERS, Member

COMMITTEE MEMBERS(Cont'd):

HAROLD B. RAY, Member

JOY REMPE, Member

MICHAEL T. RYAN, Member

WILLIAM J. SHACK, Member

JOHN D. SIEBER, Member

GORDON R. SKILLMAN, Member

NRC STAFF PRESENT:

EDWIN M. HACKETT, Executive Director, ACRS

ILKA BERRIOS, Designated Federal Official

JEFF CIOCCO

HOSSEIN HAMZEHEE

JOHN SEGALA

ANGELO STUBBS

ALSO PRESENT:

UCHIDA SAMAMOTO, MNES

ATSUSHI KUMAKI, MHI

SHINJI KAWANAGO, MNES

C. KEITH PAULSON, MNES

RYAN SPRENGEL, MNES

ATO SHIKAKA, MNES

C-O-N-T-E-N-T-S

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

(8:29 a.m.)

CHAIRMAN ABDEL-KHALIK: The meeting will now come to order.

This is the second day of the 586th meeting of the Advisory Committee on Reactor Safeguards.

During today's meeting, the Committee will consider the following: 1) selected chapters of the safety evaluation report with open items associated with the U.S. advanced pressurized water reactor design certification and the Comanche Peak combined license application; 2) future ACRS activities/report of the Planning and Procedures Subcommittee; 3) reconciliation of ACRS comments and recommendations; 4) draft report on the biennial ACRS review of the NRC safety research program; 5) assessment of the quality of selected NRC research projects; and 6) preparation of ACRS reports.

This meeting is being conducted in accordance with the provisions of the Federal Advisory Committee Act. Ms. Ilka Berrios is the designated federal official for the initial portion of the meeting.

Portions of the session dealing with the selected chapters of the SER with open items associated with the U.S. advanced pressurized water reactor design certification and the Comanche Peak combined license application may be closed in order to protect information designated as proprietary by MHI and Luminant.

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

There will be a phone bridge line. To preclude interruption of the meeting, the phone will be placed in a listen-only mode during the presentations and Committee discussion.

A transcript of portions of the meeting is being kept, and it is requested that the speakers use one of the microphones, identify themselves, and speak with sufficient clarity and volume, so that they can be readily heard.

We will now go to the first item on the agenda -- selected chapters of the SERs -- of the SER with open items associated with the US-APWR design certification and the Comanche Peak COLA.

John Stetkar will lead us through that discussion.

MEMBER-AT-LARGE STETKAR: Thank you, Mr.

Chairman. First, as a preface, the subject of this presentation and our letter, if we decide to write one, will be limited to only the design certification. I'll explain that in a moment.

As we have been doing with other design centers, we have established a review process for the US-APWR where we are reviewing individual chapters of the SER as they become available in a -- first in a draft stage of the SER with open items, and then later when the final SER chapters are available at some time after the open items are closed out.

That gives us an opportunity to get some preliminary information about particular technical issues that might be of concern either to the staff or that might raise concerns on our part, gives us a chance to have some early feedback, both to the staff and to MHI if we have particular issues that we raise questions about or feel that we need additional information.

And it has been working quite well. The purpose of this meeting and, as I said, our letter, if we decide to write one, is basically to give staff an interim update on where we stand during the review process. We have done that with some of the other design centers.

The way we are trying to run this one is that unless we identify any very significant issues that we feel merit immediate attention, I'm trying to collect chapters into groups, so that we don't have a large number of these interim letters.

And this is the first of those groups, and, in particular, we are going to cover this morning Chapters 2, which are site characteristics; 5, reactor coolant and connecting systems; 8, electric power; 10, steam and power conversion; 11, radioactive waste management; 12, radiation protection; 13, conduct of operations; and 16, technical specifications.

We will not have presentations on each of these chapters. It is, obviously, too large a list of things to cover. I have asked MHI and the staff to highlight any significant technical issues based on their reviews that they feel are appropriate to brief the Committee on.

I would ask Committee members, certainly members of the Subcommittee who have attended some, if not all, of the meetings, if you do have specific questions about focused technical issues that you would like to bring to the attention of the rest of the Committee and get on the record for this meeting, please feel free to do that. I know MHI and the staff are prepared to answer questions beyond the material that they have prepared in their presentations.

And with that introduction to kind of give the Committee members an overview of what we are up to, I guess I will turn it over to Hossein or Jeff.

MR. CIOCCO: Yes. Good morning. My name is Jeff Ciocco. I'm the lead project manager in the Office of New Reactors for the US-APWR design certification. I will be giving our presentation this morning.

However, the real people who do the work on this are the NRO and the NSIR scientists and engineers, many of whom are in the stands behind us. Some are on the phone, and many are back at their desks working as well.

So I'm going to give the overview presentation for the NRC. The one person that I will introduce is my branch chief sitting next to me here is Hossein Hamzehee, also in the Office of New Reactors in our US-APWR Projects Branch.

Thank you.

MEMBER-AT-LARGE STETKAR: Thanks, Jeff.

And with that, we will turn it over to MHI.

MR. KUMAKI: Good morning. My name is

Atsushi Kumaki from Mitsubishi Heavy Industries. It is a pleasure to attend this Committee meeting.

I am the project manager of the US-APWR design certification on Mitsubishi. Since MHI, we had submitted our DC application of US-APWR on December 2007, after that NRC reviewed and also issued SER with open item for these chapters -- 2, 5, 8, 10, 11, 12, 13, and 16.

And also, the SERS Subcommittee members reviewed the SER, and we had I think five times a meeting with Subcommittee so far.

And today I appreciate that we have a full Committee meeting for those chapters, and I would like to present our outline of those chapters.

As an introduction, our US-APWR, its basic design concept is same as the conventional four loops PWR plant. However, there are some unique features for our plant, and we selected these three items.

First one is advanced accumulator. Normally, a conventional plant has same accumulator, but our accumulator has another function. It is in place of the low head injection, so our advanced accumulator has a function for low head injection, so that we don't have any low head injection pumps.

We have much -- many discussions for this item, but we would like to explain about these features in future discussion Chapter 6. So we don't have this chapter today.

And second is digital I&C platform. We applied for this our system, for our I&C system, and also we would like to explain this feature in future discussion on Chapter 7.

Third one, last one, is emergency gas turbine generator. We applied this gas turbine generator for our emergency power source. This feature is described in Chapter 8, so we have Chapter 8 today. So later we will explain more detail for this gas turbine generator.

So I would like to start from Chapter 2. The title is the Site Characteristics. This chapter includes the geological, seismological, hydrological, and meteorological parameters. Basically, those parameters are applied for our standard design of the US-APWR. But in actual plant, a COL applicant should confirm their site characteristics are bounded or provide site-specific qualification.

And we -- NRC reviewed this chapter, and we exchanged many RAIs with NRC. And that SER has some open items, but after that, right now, we close all open items and we responded to all RAIs. So at this moment, there is no issue to be discussed.

Next is Chapter 5, Reactor Coolant and Connecting Systems. This chapter addressed the integrity of the reactor coolant pressure boundary, which consists of the reactor vessel and the four reactor coolant pumps and four steam generators and their subsystems, such as RHR system, and so on.

And also, this chapter has no issue to be discussed. Yes?

MEMBER-AT-LARGE STETKAR: Have you and the staff resolved all of the questions about integrity of the reactor coolant pump seals during station blackout conditions? I know we had some discussions during the Subcommittee meeting about justification for the timing or amount of seal leakage if there was no cooling for the reactor coolant pump seals. And that could occur either during a station blackout or during failures of -- for example, failure of component cooling.

Have you resolved all of the questions with the staff on those issues?

MR. KUMAKI: Yes. MHI already submit our response to NRC.

MEMBER-AT-LARGE STETKAR: Okay.

MR. KUMAKI: And they right now may be

under discussions.

MEMBER-AT-LARGE STETKAR: Okay. Okay. Thank you.

MR. KUMAKI: The next is Chapter 8. The title is Electric Power. This chapter includes offsite power system and onsite power system, AC power system, DC power system, and especially described about the station blackout.

This chapter has Class 1E gas turbine generators. We applied this generator for the emergency power source.

And the next slide is a small explanation about the gas turbine generator.

Left side is a picture of the -- our prototype generators, and our specification for this generator, the code class is 1E and the seismic category is one, rated output is 4,500 kilowatts.

The starting is less than 40 seconds, which is bounded by 100 seconds using for the safety analysis assumption. Starting system is air, and we performed qualification tests including initial type tests and the seismic tests based on the IEEE standards.

This slide describes our -- about the -- some kind of tests and RAIs. Also, qualification tests, we performed initial type tests from September through December 2010, last year. We performed the load capability test, start and load acceptance test, and the margin test.

Those test rests are shown in the -- our technical report MUAP-10023. Initial type test results is already shown in Revision 1 of this technical report, which is -- at the beginning of this year we submitted.

And next is a seismic test of a turbine engine. We performed this test from March to April of 2011, this year. Testing consists of 5 OBE and -- OBE meaning operational base earthquake -- and the two safe shutdown earthquake tests using the DCD required response spectra.

MEMBER SHACK: Have you submitted R2 yet? I only have R1. I'm just -- am I behind on the technical report?

MR. SPRENGEL: This is Ryan Sprengel. We just submitted that the end of August, so that should be -- is being processed now.

MR. CIOCCO: That's correct. This is Jeff Ciocco with the NRC, and we just received it a couple days ago, so it's being processed right now.

MR. KUMAKI: So this technical report

Revision 2 has been submitted end of August.

MEMBER SHACK: How will you be planning to demonstrate seismic margin for the gas turbine? Will that be by test or by analysis?

MR. KUMAKI: We perform the actual shaker --

MEMBER SHACK: Yes, but that's for SSC. Now, you are --

MR. KUMAKI: Yes.

MEMBER SHACK: -- going to have to demonstrate a seismic margin.

MR. KUMAKI: Okay. I would like to ask our engineer.

MR. KAWANAGO: It's basically the seismic margin now for the gas turbine generator itself, and we -- and we have the plant to have done some kind of calculation of --

MEMBER CORRADINI: Analysis?

MR. KAWANAGO: Analysis, yes.

MR. KUMAKI: And then, next is major RAIs. We received RAIs from NRC. Basically, those RAIs are categorized by two -- reliability and diversity.

As for the reliability, we have reported reliability of variation details in the -- our technical report Revision 2. And also, diversity for these items, we have committed to use different manufacturers for the Class 1 gas turbine and the alternate AC gas turbine generators.

MEMBER-AT-LARGE STETKAR: We had -- for the benefit of the members, they are also using smaller, different rated gas turbine generators for their station blackout alternate AC power supplies. So this plant does not have any diesel generators, and there have been substantial discussions between the staff and MHI regarding gas turbines, because I think this is the first application that we will see in the United States that uses strictly gas turbines for all emergency and station blackout power supplies. So it's a new design concept, if you will.

I was going to ask you, we also had substantial discussions about reliability estimates for the gas turbine generators. And I know you have done the testing, and we had a fairly extensive briefing on the testing.

There were still some open questions about what is defined as a gas turbine generator and what is included in the scope of the reliability, in particular, when comparisons are made between what is defined as a gas turbine generator for the purpose of these reliability estimates and what is defined as a diesel generator for comparative reliability estimates.

The scopes seem to be different. In particular, the scope of the data for diesel generators typically includes failures of the starting signals and failures of the output breaker from the generator, and the reliability data that you've been presenting for the gas turbine generators exclude those two peripheral pieces of equipment, which can in fact add numerical value.

So have you gone back yet, and are you revising the reliability estimates to -- when you make the comparisons with emergency diesel generator reliability, are you in the process of getting that potential discrepancy between the scope of where you draw the boundaries around pieces of equipment resolved?

MR. KUMAKI: Should we talk about the PRA assumption?

MEMBER-AT-LARGE STETKAR: It's not really a PRA assumption, because it's in the context of the reliability. Several questions have been asked by the staff, and by our Subcommittee members, regarding comparative reliability of gas turbine generators with emergency diesel generators, because in the U.S. there is a fairly good database on reliability of emergency diesel generators.

There is variability, of course, from plant to plant and manufacturer to manufacturer, but fairly decent data. And some of the justification for the use of gas turbine generators has been made based on their relative reliability compared to emergency diesel generators.

So in that context, not in PRA context but in the context of gaining assurance about the use of this type of machine compared to a diesel generator, it's important to understand if we are comparing reliability of X and Y that the scope of what is included in the boundaries for X and Y are both consistent.

So I think during our Subcommittee meetings we had some questions about that issue, and I was curious about where that discussion stands at the moment.

MR. KAWANAGO: Yes. And we understand well your question, and, of course, we would like to answer it. We don't yet draft a response to the NRC and staff on this question. And, however, the main discussion point is the scope of that. And, as you said, it's a emergency power supply system, especially the NUREG-6928. This one is clearly stated. It is emergency diesel generator's boundary includes output breaker.

We checked its intent should be, so that content -- so main difference now of our reliability data and scope is mainly only this -- only that --

MEMBER-AT-LARGE STETKAR: Okay.

MR. KAWANAGO: -- it is out of breaker.

MEMBER-AT-LARGE STETKAR: Okay.

MR. KAWANAGO: And our calculation is out of the -- in a gas turbine generator, and basically the 3.5 and a 10^{-4}. It's order is 10^{-4}. And diesel generator and NUREG data is .053 times 10^{-3}. So we explain to you, and it's gas turbine generator, and it's -- and the reliability for diesel -- one order is lower than diesel generator.

MEMBER-AT-LARGE STETKAR: On the other hand, if the output breaker has --

MR. KAWANAGO: Yes. Sure, sure.

MEMBER-AT-LARGE STETKAR: -- an unreliability of two times 10^{-3}, you would actually be much closer.

MR. KAWANAGO: Yes, yes. So I think it's what we have tried to say, and in our PRA and PRA model has, -- not only for the diesel generator or gas turbine generator but also the -- an output breaker, our PRA's model, it's a gas turbine generator, also the output breaker.

MEMBER-AT-LARGE STETKAR: Separately, okay.

MR. KAWANAGO: And also -- and when we see actually the data of the output breaker, it is typically the IEEE and Standard 500, it's four times -- four times 10^{-4}. So the --

MEMBER-AT-LARGE STETKAR: Don't use that reference.

MR. KAWANAGO: No.

(Laughter.)

So that basically the -- basically, what we would like to answer to you, in the near future, and even we -- we added the reliability of the output breaker. But, still, the reliability is a good --

MEMBER-AT-LARGE STETKAR: Okay.

MR. KAWANAGO: That is our current -- it's an idea to answer to.

MEMBER-AT-LARGE STETKAR: Thank you. That helps.

MEMBER BROWN: Could I ask a question?

MEMBER-AT-LARGE STETKAR: Yes. We're fine for time here. We've got the whole -- this is -- you know, the purpose is to give --

MEMBER BROWN: I can't remember whether I asked this question or not in the Subcommittee meeting, so I thought I would repeat myself.

MEMBER-AT-LARGE STETKAR: -- input.

MEMBER BROWN: These are air start, as most gas turbines are. And you've got an air receiver, and it's got a certain capacity -- 1,250 gallons, or something like that, according to your document. How many starts can you run -- is it one air receiver for gas turbine, or is it one air receiver for all of them?

MR. KAWANAGO: Basically, our design is each plant -- each plant has its dedicated air receiver.

MEMBER BROWN: Okay.

MR. KAWANAGO: Okay? That is completely independent system.

MEMBER BROWN: Okay. How many starts can you do without recharging?

MR. KAWANAGO: Without recharging, it's one gas turbine engine that can start just three times.

MEMBER BROWN: Three times, okay.

MEMBER SIEBER: It's a package unit,

right?

VICE CHAIRMAN ARMIJO: I had a question, just for clarification. What is the difference between the 1E gas turbine generators and the AACs? I don't understand that.

MR. KAWANAGO: Its meaning -- AAC is alternate AC power source. It's mainly we will use for the -- in a station blackout, in the case of a station blackout.

MEMBER CORRADINI: It's a different system, as I understand it.

VICE CHAIRMAN ARMIJO: Yes, a different system. But is it the same gas turbine design, same size, same --

MR. KAWANAGO: No. No.

VICE CHAIRMAN ARMIJO: Very different.

MR. KAWANAGO: No. It's -- we committed to that in our -- we used a different design and a different manufacturer from an emergency power supply system, gas turbine engine.

MEMBER SIEBER: Right.

VICE CHAIRMAN ARMIJO: Okay. But the outputs are the same and --

MR. KAWANAGO: No, no, no.

VICE CHAIRMAN ARMIJO: They are very

different.

MR. KAWANAGO: It's -- output is -- it's a different, it's a slightly -- the emergency power supply.

MEMBER-AT-LARGE STETKAR: And if I recall, there are two alternate AC GT -- AAC GTGs.

(Laughter.)

You can probably say it easier than I can.

MEMBER SKILLMAN: May I please ask, what was the equipment that was included in the qualification test, please?

MR. KAWANAGO: Qualification test, it's -- I think it's -- we can show you the picture of the -- our technical effort is slightly -- however --

MEMBER CORRADINI: What was the type of equipment tested, I think is what --

MEMBER SKILLMAN: I'm asking whether or not it was the gas turbine, the speed reducer, plus the alternator, as a combined package.

MR. KAWANAGO: It's a generator and the gas turbine generator and the starting system and the cooling system. But this is actually the -- an air cooling, and also the -- and a combustion air system and the fuel oil system and the governor and its exhaust gas control system. It's the inside of the gas turbine generator that -- it started inside.

MEMBER SKILLMAN: In the alternator?

MR. KAWANAGO: It's -- alternator is -- is that --

MEMBER SIEBER: It's all on the same --

MR. KAWANAGO: Yes, yes, that's right.

MEMBER SKILLMAN: Thank you.

MEMBER-AT-LARGE STETKAR: The interesting thing on this one, Rich, is they talk about it. If you go back to the photographs that you have, these -- you'll notice two combustion chambers there. These are actually two small tandem gas turbine generators, one through -- essentially a gear box through a single electrical generator.

So it's a little more complex than just a single in-line gas turbine running a generator. And I believe essentially what you see in that photograph with the generator hung on it was put on the shape test, the shape gauge.

MEMBER SKILLMAN: I was wondering if we go from air and fuel to megawatts --

MEMBER-AT-LARGE STETKAR: Yes, I --

MEMBER SKILLMAN: That's my -- that's the real question.

MEMBER-AT-LARGE STETKAR: I believe that

was the case, and I that's -- we asked them about that.

MEMBER SKILLMAN: Is the answer yes to that question? The entire -- the package that you have tested is actually from combustion air and fuel to power output? Like if power --

MR. KAWANAGO: That's right. That's right.

MEMBER SKILLMAN: Thank you.

VICE CHAIRMAN ARMIJO: I think there was a video showing --

MEMBER-AT-LARGE STETKAR: There is a video. I have a video that actually shows the shape test.

VICE CHAIRMAN ARMIJO: And the big box with all sorts of stuff in it.

MEMBER-AT-LARGE STETKAR: Yes.

VICE CHAIRMAN ARMIJO: Okay.

MEMBER BROWN: Another one if I can? Since they are separated by divisions, which is obviously what we would like to see, since there is only three starts on any air receiver, and in the unlikely event that you have an unusual circumstance where you really are unable to recharge, is there an interlocked -- I'll call it that -- capability to cross-connect an air receiver from one division to another, if you needed to --

MR. KAWANAGO: No, no.

MEMBER BROWN: -- in the overall --

MR. KAWANAGO: No.

MEMBER BROWN: So they are literally separated.

MR. KAWANAGO: Separated, completely separated.

MEMBER BROWN: And there is no ability to connect them if you had to.

MR. KAWANAGO: Completely separated.

MEMBER BROWN: The next question was, the only gas turbines -- I'm not a gas turbine guy, but the Navy uses them, and they periodically have to pull them out, refurbish them, and put them back in. Is there -- what's the maintenance cycle for --

MEMBER SIEBER: Yes, there is.

MEMBER BROWN: Is it a five-year cycle, a 10-year cycle? Is it based on number of hours?

MEMBER SIEBER: Hours.

MEMBER BROWN: Have you got some feel for that?

MR. KAWANAGO: Hold on.

(Pause.)

It's basically when we have -- it's a maintenance outage in, of course, a plant, okay? And it's one and a half years or one year or two years. And basically we don't -- and we just have the maintenance to have the fiber scope and checking inside.

MEMBER BROWN: So you are to do an interior inspection each maintenance outage, every two years roughly?

MR. KAWANAGO: Yes. But only by using a fiber scope and checking inside. But over the -- and when we have a long time over the -- and 3,000 hours or 2,000 hours, and we need to have --

MEMBER BROWN: That's an endurance run time, where you can continue --

MR. KAWANAGO: Continue it.

MEMBER BROWN: Okay.

MR. KAWANAGO: Continue it. It's accumulate -- accumulate --

MEMBER BROWN: Cumulative.

MR. KAWANAGO: -- accumulate. And we need to have the -- overhaul on the maintenance, and that is -- and checking inside everything, but --

MEMBER BROWN: That's based on hours.

MR. KAWANAGO: Yes, hours.

MEMBER BROWN: Hours of operation.

MR. KAWANAGO: But basically, it's a periodic test, and monthly test is just two hours or something like that. So that when you divide it it's 2,000 hours and -- by two and it takes -- and it's --

MEMBER BROWN: It takes a few years.

MEMBER-AT-LARGE STETKAR: Well, I mean, every outage you typically have to run them for 24 hours I think and things like that, but it's a few years between major overhauls.

MR. KAWANAGO: So our maintenance in a plant is basically that when we have the 15 years and after that, and we have the overhaul maintenance. But -- and meanwhile, it's one year, two years, two three years, or four years, just having an inspection, checking the inside by using a fiber scope.

CHAIRMAN ABDEL-KHALIK: How much fill do you have onsite, and how is it stored?

MR. KAWANAGO: It's gas turbine generator?

CHAIRMAN ABDEL-KHALIK: Yes.

MR. KAWANAGO: It's basically the -- on a concrete shelf is one ton for the one on a gas turbine generator, and the capacity is seven days.

CHAIRMAN ABDEL-KHALIK: Seven days.

MR. KAWANAGO: Yes.

CHAIRMAN ABDEL-KHALIK: And what is the pressure of the gas in the tank?

MR. KAWANAGO: Pressure?

CHAIRMAN ABDEL-KHALIK: What is the gas pressure?

MR. KAWANAGO: Gas pressure?

CHAIRMAN ABDEL-KHALIK: Gas turbine burn anything?

MR. KAWANAGO: Sorry, sometimes we have -- you have confusion, because we use --

CHAIRMAN ABDEL-KHALIK: No problem.

MR. KAWANAGO: Sorry.

CHAIRMAN ABDEL-KHALIK: No problem.

MR. KUMAKI: Shall I move on? Next?

MEMBER-AT-LARGE STETKAR: Yes, please.

MR. KUMAKI: Our next chapter is 10, Steam and Power Conversion System. This chapter includes turbine generator and the steam and power conversion system, such as condenser or feedwater system, and so on. And also, this chapter has no issues to be discussed.

MEMBER-AT-LARGE STETKAR: And interesting, for the benefit of the other Committee members, although this chapter is called Steam and Power Conversion System. The scope of this chapter also includes the emergency feedback system.

And we had some discussion at the Subcommittee meeting regarding the emergency feedwater system. You have two motor-driven emergency feedwater pumps and two turbine-driven emergency feedwater pumps.

There has been an issue raised -- and we had some discussion in the Subcommittee meeting about it -- the -- this is related between Chapter 10 and Chapter 8. One of the things that we try to do in our Subcommittee meetings is to connect the dots among the different chapters that we review individually.

The rated life of the station batteries is two hours -- the emergency DC batteries on this plant. The turbine-driven emergency feedwater pump requires DC for operation. However, MHI has identified an issue that the turbine-driven emergency feedwater pump also requires room cooling. That's correct?

MR. KAWANAGO: Yes.

MEMBER-AT-LARGE STETKAR: The room cooling is AC powered. So the turbine-driven emergency feedwater pump effectively requires AC power to support its operation. They have done analyses, and we have asked for the analyses to show that the turbine-driven emergency feedwater pump indeed can remain operating for at least one hour, because that's the nominal time that they include credit for connecting those alternate AC gas turbine generators, if the members can follow the convoluted logic here.

Essentially, during a loss of all AC power, they -- because of the design and manual requirements for the alternate AC gas turbine generators, say they need -- they are essentially saying they need one hour.

MEMBER CORRADINI: They may not, but that's what they are --

MEMBER-AT-LARGE STETKAR: They may not, but the analyses -- the station blackout coping analyses say one hour.

MEMBER CORRADINI: And so the emergency aux feedwater pump room would -- or turbine room would heat up to a point that it would not --

MEMBER-AT-LARGE STETKAR: They say it will be okay for an hour. We don't know how long --

MEMBER CORRADINI: Okay.

MEMBER-AT-LARGE STETKAR: -- past an hour it may fail, nor have we seen any of the analyses that indeed confirm that the -- you know, the temperatures will remain less than the qualifications or rated operating temperatures of all of the equipment in that room for an hour.

MEMBER CORRADINI: The critical components are seals for the turbine, something --

MEMBER-AT-LARGE STETKAR: No, it's probably electronics for the turbine speed control.

MEMBER CORRADINI: Okay.

CHAIRMAN ABDEL-KHALIK: Is the heatup of the aux feedwater pump room during an event of this type something that would need to be revisited during COLAs?

MR. KUMAKI: That means operate -- go to that room?

CHAIRMAN ABDEL-KHALIK: The heatup of the aux feedwater.

MR. KUMAKI: No, we don't.

CHAIRMAN ABDEL-KHALIK: So you think that the response of the aux feedwater pump room during this total loss of AC is something that will be specified in the DCD and won't have to be revisited during COLA applications?

MR. KUMAKI: What is --

MR. SAMAMOTO: This is Uchida Samamoto, MNES. We discussed this in the Subcommittee. That is why we only use the one hour is because we can't use AAC power after one hour. So we --

(Microphone feedback.)

-- emergency feedwater pump can't use after one hour for that --

(Microphone feedback.)

-- assumption for the --

MEMBER-AT-LARGE STETKAR: Stand back a little bit, and somebody -- Theron, can you turn down the gain a little bit? Because we're getting a little feedback, even on the table here.

MR. SAMAMOTO: We explained the basis with HVAC. We already calculated that in Chapter 19.

MEMBER-AT-LARGE STETKAR: Okay.

MR. SAMAMOTO: Chapter 19 is calculated without HVAC system in emergency power --

MR. KAWANAGO: Our answer is -- sorry -- in Chapter 19. In a DCD scope in Chapter 19, we calculate, and, actually, the temperature of the room of the emergency feedwater pump within one hour. Within one hour. So that means that is a DCD scope, not the COLA scope.

MEMBER-AT-LARGE STETKAR: Okay. I think what -- is there any requirement for the COL applicant to confirm that heatup by actually running a test and measuring the temperature in the room? I know you do a calculation, but the calculation is the basis for justifying the design. Is there any requirement that the COL applicant actually run a test and verify that the temperature remains below the calculated limit?

MR. KAWANAGO: I think there are two elements. One is, first, at least a COL applicant needs to check whether the condition of the calculation is bounding by the DCD or not. That is Chapter 2 basis, and it's what is environmental -- the condition, and we need to check. Okay? That is a COL applicant, and it's an important element.

And also, and in ITAAC -- in ITAAC, in the stage, and COL applicant needed to check. And whether, actually, there is a design condition and it's actually the -- it's the same. We think that is the --

CHAIRMAN ABDEL-KHALIK: But this is just comparing the site conditions and making sure that they are within the --

MR. KAWANAGO: Sure.

CHAIRMAN ABDEL-KHALIK: -- envelope.

MR. KAWANAGO: Yes, sure.

CHAIRMAN ABDEL-KHALIK: But no requirement for an actual test to confirm the validity of the calculation. Is there?

MR. SAMAMOTO: This is Uchida Samamoto

again. We don't request COL applicants to perform such a test, you know, request of --

MR. KAWANAGO: This is because we clearly explained to you, and basically that calculation basis we only use the design parameter of the pumps and also the -- and equipment, okay? So that means -- and when, actually, we go to the manufacturing stage, in the manufacturing stage or procurement stage, each pump, not including a diesel emergency -- an emergency -- feedwater pumps or every safety-related component will be tested -- will be tested in the manufacturer. Okay? So need to check whether that pump can meet the design requirement or not.

If the manufacturer shows our -- we can show that equipment meet to the design criteria, that is actually the meet to the -- meet to the condition of the calculation of Chapter 19.

VICE CHAIRMAN ARMIJO: So you will test higher temperature, qualify for the higher temperature. But I think the question was --

MR. KAWANAGO: But the --

VICE CHAIRMAN ARMIJO: -- are you verifying?

MR. KAWANAGO: -- design basis.

VICE CHAIRMAN ARMIJO: I thought the

question was: how do you verify that the temperature will be what you expect it to be in the room?

MR. KAWANAGO: Actually, by using a test. The answer is no.

MEMBER-AT-LARGE STETKAR: Okay. We will -- I think that's something we can follow up with the staff, because that's typically something that the staff may ask to be included.

MR. PAULSON: Well, you're looking at -- or what you're asking is a starting point, is --

MEMBER-AT-LARGE STETKAR: An in situ test.

MR. PAULSON: Right.

MEMBER-AT-LARGE STETKAR: He starts the turbine, runs it, and --

MR. PAULSON: Based on what the temperature is meant to be in that room, and look at the heatup based on the performance of equipment, and see where it ends up in an hour. And is it under the temperature --

MEMBER-AT-LARGE STETKAR: Given actual room conditions with the actual installation properties of the room --

MR. PAULSON: I think we understand the question. We'll --

MR. KAWANAGO: We understand.

MR. PAULSON: We'll respond.

CHAIRMAN ABDEL-KHALIK: What is the temperature limit?

MR. SAMAMOTO: I can answer. Basically, Chapter 9 is -- calculation is over eight hours.

CHAIRMAN ABDEL-KHALIK: It can't be eight hours.

VICE CHAIRMAN ARMIJO: One hour.

CHAIRMAN ABDEL-KHALIK: What is the temperature limit? What is the limit at which --

MR. KAWANAGO: I think it's -- we will answer later. It's okay?

MR. SAMAMOTO: But my understanding is basically instrument temperature is limiting to --

MR. KAWANAGO: Numbers.

MEMBER-AT-LARGE STETKAR: What he's asking for, basically -- whatever the limiting equipment, it's probably the electronics and the turbine control system, what are the -- you know, what's the design qualification temperature for those electronics? I could speculate, but it's better for you if --

MR. KAWANAGO: I'm sorry. We checked -- 50 degrees Celsius. That is design limiting.

MEMBER-AT-LARGE STETKAR: Okay.

MR. PAULSON: What, it's 122 degrees

Fahrenheit?

MEMBER-AT-LARGE STETKAR: That's pretty standard for most electronics. I wanted to make sure there wasn't anything else that was a surprise. But that's also a fairly modest temperature if you have a well-insulated concrete room with some steam lines going into it, so -- especially if it's a relatively small room.

MR. KUMAKI: So move on?

MEMBER-AT-LARGE STETKAR:

Any other questions about emergency feedwater?

CHAIRMAN ABDEL-KHALIK: Let me just follow up on this calculation of the maximum room temperature over a one-hour period where the HVAC system is not operational, presumably.

I assume that you rely on heat transfer through the walls of the room. What if you assume totally adiabatic conditions, how long does it take to reach that 122 degree F or 50 degrees C, without heat transfer across the walls of the room?

MR. KUMAKI: I understand.

MEMBER-AT-LARGE STETKAR: In fairness to MHI, we haven't seen Chapter 19 or those calculations yet. So we're treading a little bit beyond -- it's fair to ask the questions, but they may not have the appropriate people here.

CHAIRMAN ABDEL-KHALIK: Well, this is a very important piece of equipment.

MEMBER-AT-LARGE STETKAR: Yes.

MR. SHIKAKA: Yes. This is Ato Shikaka. We haven't done the calculation for that. When we submitted the response, the calculation results in Chapter 19 RAI response, has been submitted I think this May or June timeframe. I think it is in review right now.

CHAIRMAN ABDEL-KHALIK: But the first statement you made, that you have not done the adiabatic --

MR. SHIKAKA: Correct.

CHAIRMAN ABDEL-KHALIK: -- calculations.

MR. SHIKAKA: Right.

CHAIRMAN ABDEL-KHALIK: Okay.

MEMBER-AT-LARGE STETKAR: This is a bit of a problem we get into. It's efficient for us to review chapters on a chapter-by-chapter basis, but, as you see, there are some issues that sort of bridge among several chapters.

What we're discussing now is kind of a Chapter 8, Chapter 10, Chapter 19, and perhaps Chapter

9 that covers ventilation systems issue, which is one of the functions that we perform. But at times the timing of our review doesn't necessarily coincide with the functional requirements for some of the systems.

So this is an issue, by the way, that we are tracking from the Subcommittee meetings, the justification for the room heatup analyses and not only the survivability for an hour but what -- how long could the turbine survive, actually, without AC cooling? Which is a different issue in terms of long-term operation under no AC power conditions.

MR. KUMAKI: So I should move on?

CHAIRMAN ABDEL-KHALIK: How about manual control of the turbine-driven aux feedwater pumps? Can the operator manually control the pumps?

MR. KUMAKI: We don't need manual control.

VICE CHAIRMAN ARMIJO: That wasn't the question.

(Laughter.)

MR. KUMAKI: The question was, can --

VICE CHAIRMAN ARMIJO: Is it possible?

MR. SAMAMOTO: We would like to confront -- you mean the manual is manual startup?

MR. KUMAKI: I think it's --

MR. SAMAMOTO: A few lines by manual, it's possible. But basically, we can't start up from that main control room manual switch, but we can use open -- startup by manual.

MR. SPRENGEL: This is Ryan Sprengel. On those, I think they're asking -- correct me if I'm wrong -- if you can manually control the speed.

CHAIRMAN ABDEL-KHALIK: The startup and speed.

MEMBER-AT-LARGE STETKAR: I tend to call it mechanical rather than manual, because it avoids the notion of pushing buttons. This is someone locally in the room operating the steam admission valve to control the turbine.

MEMBER SIEBER: Yes. What kind of governor does it have? Is it water? Usually there's not --

MR. KAWANAGO: This is steam driven.

MEMBER-AT-LARGE STETKAR: Just speak up in the mic. We need to have you on the record here.

MR. KAWANAGO: What we answered to you is that in the main control room there is a manual switch, and operator can start manually. And also, when they go to the -- it's -- on a local site, and operator can work it in manually, and it can start in a turbine-driven --

MEMBER-AT-LARGE STETKAR: There's no electrical signal that will override it.

MR. KAWANAGO: No, no. No. We don't need to do half the DC power. We don't need to do half the DC power. If the operator goes through the --

CHAIRMAN ABDEL-KHALIK: Local control.

MR. KAWANAGO: Yes.

CHAIRMAN ABDEL-KHALIK: Thank you.

MR. KUMAKI: Next chapter, Chapter 11, Radioactive Waste Management. This chapter includes the kind of waste management systems for liquid, gaseous, and solid. I think this is -- there is no issue for the -- to be discussed.

And next, Chapter 12, Radiation Protection. This chapter includes the discussion about the radiation sources, radiation protection design features, and the dose assessment. And also, we exchange many other errors. And right now we have no issues to be discussed.

Chapter 13 is Conduct of Operations. This chapter includes information relating to the preparation in the plant for US-APWR plant design, construction, and operation. And those are -- this chapter includes kind of security issues.

Also, we exchanged many other errors with the NRC, and there are some open items. But right now we closed all open items. There is no issues to be discussed.

This is the last chapter of this today, Chapter 16, Technical Specifications. Basically, US-APWR technical specification is the same, almost same as the standard technical specification as addressed in NUREG-1431 for the Westinghouse plant. This chapter includes safety limits, limiting safety system setting, limiting condition for operation, surveillance requirements, design features, and administrative controls. And also, this chapter has no issues to be discussed.

MEMBER-AT-LARGE STETKAR: Chapter 16, for the design certification you have, as you mentioned, only the standard technical specifications. Is that correct?

MR. KUMAKI: Most of it.

MEMBER-AT-LARGE STETKAR: Most.

MR. KUMAKI: Yes.

MEMBER-AT-LARGE STETKAR: The reason I ask the question is I believe that, in particular, the reference combined license applicant, Comanche Peak, has indicated that they intend to risk-inform the technical specifications. That's -- but from the purpose of the design certification, there is no risk information in the technical specifications, is that correct?

MR. KUMAKI: Yes, correct.

MEMBER-AT-LARGE STETKAR: Okay. Thank you. That's also a difference when we come to the COL review for this particular design center, the reference COL plant anyway. Comanche Peak has indicated that they are interested or intending to submit risk-informed technical specifications, and that also is the only design center that has indicated that so far. So that's a different issue that we will have to address as a committee when we review the COL application for Chapter 16.

MR. KUMAKI: So this is the end of my presentation of today. I thank you very much for your attention.

MEMBER-AT-LARGE STETKAR: Do members have any other questions or comments on any of these chapters?

MEMBER SKILLMAN: I do. I would like to explore a little bit what is really open on the advanced accumulator in the absence of low head safety injection pumps. Your comment, Kumaki-san, is that this is part of future discussion. And I am curious what the features of that future discussion will be, please.

MR. KUMAKI: So our advanced accumulator has a flow damper. That flow damper can change the flow rate from large flow to small flow, so we -- our advanced accumulator injection flow has two flows. So we tried to explain about -- for those features or systems or our assumption, and also we exchanged many RAIs with NRC, especially NRC requested us to calculate using a CFD calculation. So we will explain for those kind of things in future.

MEMBER-AT-LARGE STETKAR: That's covered, Dick, under Chapter 6 of the safety evaluation report, which is somewhere out in the schedule.

MEMBER SKILLMAN: Thank you.

MEMBER-AT-LARGE STETKAR: They have a separate technical report that they submitted. We have had -- I don't recall right now whether it was a full committee or subcommittee briefing on the design of the accumulator. I think it was -- was it full committee, Dennis?

MEMBER BLEY: It was back when Otto was still here.

MEMBER-AT-LARGE STETKAR: Yes. So a couple of years ago. There have been extensive -- and we are going to discuss that, I'm sure, in a lot of detail under Chapter 6 when it comes before us.

MR. SPRENGEL: Let me be clear -- this is Ryan Sprengel -- we do have an accumulator topical report. So you --

MEMBER-AT-LARGE STETKAR: It is topical.

MR. SPRENGEL: And you have a CFD technical report supporting that.

MEMBER-AT-LARGE STETKAR: So there will --

MR. SPRENGEL: I'm sorry. I didn't recall whether it was technical or topical. I get them --

MEMBER-AT-LARGE STETKAR: Thank you.

MR. SPRENGEL: -- mixed up in my thoughts.

MEMBER-AT-LARGE STETKAR: Thanks, Ryan.

MEMBER BROWN: My memory is we did not -- we didn't go through a whole lot of detail.

MEMBER-AT-LARGE STETKAR: They will be addressed in detail during Chapter 6, and probably Chapter 15 also, neither of which is on our short-term horizon yet.

By the way, if you're having discussions, we need to have them on the record. So just be careful.

Any other questions, comments, for MHI?

(No response.)

Thank you very much. I appreciate the way you organized the discussion. I think you highlighted the points that we wanted to highlight, and I appreciate your responsiveness to our questions. So thank you.

And with that, we will ask the staff to come up.

(Pause.)

Jeff, are you ready?

MR. CIOCCO: Okay. Good morning. My name is Jeff Ciocco. I am the lead project manager for the US-APWR design certification for the NRC. I have been the lead project manager on this I think since dating back to about 2006. So we will go through today kind of an overview.

First, I will cover where we are as far as the licensing overview for the entire project, a quick summary of the safety evaluation reports, and then what we consider one of our technical challenges, as we talked about, our gas turbine generator, a unique design feature.

A lot of information on this page. This is our chronology of this design certification. We started a pre-application activity, holding a series of about eight public meetings beginning back in July of 2006. On New Year's Eve of 2007, Mitsubishi tendered its US-APWR design certification.

In between the pre-application and the submittal of the application, we also received 13 topical reports, some of which you heard about today, the advanced accumulator. So those topical reports are also -- staff is preparing safety evaluation reports. We received topical reports in the areas of the fuel design, of the advanced accumulator, of the digital I&C accident analysis, non-LOCA, large break LOCA, small break LOCA, as well as human factors engineering.

Two of the topical reports we have completed SERs. One has been through the ACRS, and that is our defense-in-depth D3. We did about a three-month acceptance review of the application, and we docketed the application the end of February of 2008.

At that time, we established an overall schedule for the design certification review. And then, in August of 2008, we had our first revision of our design control document, our first revision of three. We're on Rev 3. And this revision came in because of engineering changes. The initial application came in.

There was a design plan to complete certain areas of the application, such as the piping systems components, digital I&C, which weren't fully completed when the application was tendered. But there was a plan to get it, as well as the sump design.

So Revision 1 came in in October 2008 because of engineering changes, as well as some RAI responses. Mitsubishi will update the application. And with that design control document, I must add that there was about 150 technical reports referenced in that design control document, as well as the 13 topical reports.

And there was a period of time, as John Stetkar mentioned, between February 2008 through about May of 2009, Mitsubishi and the NRC staff conducted informational briefings to the ACNW -- or, I'm sorry, ACRS Subcommittee back into the --

MEMBER-AT-LARGE STETKAR: They still existed, I think, at that time.

MR. CIOCCO: Yes, I know. I'm looking at Dr. Ryan. But we have been to the ACRS Subcommittee probably at least 13 times, and we did informational briefings. We introduced the US-APWR design. We talked about the advanced accumulator, all of our fuel design topical reports, digital I&C, human factors engineering, which I think we also supported the trip to the human factors simulator up in MEPE in Pittsburgh back then.

We talked about the LOCA topical reports, as well as our gas turbine generator. I think there has been two or three informational briefings. And we are also conducting -- MHI is going to present an informational briefing on the long-term cooling on the GSI-191 on this November 30th to the ACRS Subcommittee.

So moving along, in June of 2009, the Phase 1 review was completed. That is the initial review where we issue RAIs, and we complete a very preliminary safety evaluation report with all of the open items. And then, in October 2009, Revision 2 of the design control document came in.

At that time, there is now the RCOLA for Comanche Peak Units 3 and 4, there were some changes in supplier information as well as the engineering progress, and RAI responses were incorporated into that Revision 2.

And then, encompassing the period of May of last year through August this year, up to the present, we completed our Phase 2 review of these eight chapters that we're talking about today. And we presented all of those eight chapters to the ACRS Subcommittee.

And then, finally, the end of March this year, the current revision is Revision 3 -- was submitted to the NRC. It's on the docket. A lot of changes in this revision. There are engineering changes along the way due to RAI responses. There was an ITAAC improvement effort. There were some engineering simplified layout drawings, conceptual design information, etcetera, that came in with our Revision 3 of the DCD. And that's currently what the staff is working on.

And a lot of the SERs that were submitted that we are talking about today were actually written back on Revision 2. So as we progress through Phases 4, 5, and 6, they will be updated to the most current revision of the DCD.

Next is our review schedule. As you can see, we operate under a six-phase licensing review process followed by rulemaking at the very end. Phase 1 was completed back in 2009. Phase 2 is where the really heavy lifting goes. Most of our licensing review, the manhours are put into Phase 2. We don't move -- we don't complete a Phase 2 review until we are pretty sure that we have resolution on the open items and a good path forward, which is, as this schedule says, January 2012.

I will say that this schedule is currently under evaluation. We have some additional scope and some particularly challenging areas, as in the seismic and structural analysis in Chapter 3, 3.7, 3.8. So this schedule is under evaluation for possible schedule extension, to incorporate the additional scope.

And then, Phase 3 -- and we do go -- and Phase 3 as a chapter is completed and delivered to the ACRS. We then schedule our briefing, so there are a lot of things done in parallel. In Phase 4, we will complete the SER with no open items, come back in Phase 5, address the open items with the Committee, and any questions they have, and then we'll issue the FSER followed by the rulemaking.

I have one slide to cover all of our chapters that we have. To date, we have completed Chapters 2, 5, 8, 10, 11, 12, and 13, as we heard from MHI, and Chapter 16, our tech specs. They have been issued to MHI. They have been made publicly available, and they have been presented to the ACRS Subcommittee.

We have issued many, many RAI questions, in the thousands. We are on about 4,800 questions in total, which have resulted in a number of open items, which we have presented to the ACRS Subcommittee as well.

There are no significant technical issues for any of these chapters, and that's not to say that there aren't challenges. We believe that we are on a good path to resolution for the open items that we have identified in these chapters, or we certainly wouldn't be moving out of Phase 2.

There are unique design features, a lot of them you are going to hear the next time we come to the full Committee -- Chapter 4 in the fuel design; Chapter 6, we heard the advanced accumulator, the digital I&C, the entire accident analysis; and the PRA in Chapter 19. So we have a lot to do yet, a lot of work going on, but no significant technical issues in these first eight chapters that we have.

CHAIRMAN ABDEL-KHALIK: Would you care to comment about the question that was raised to the applicant regarding the adequacy of this one hour calculation for the temperature in the aux feedwater room?

MR. CIOCCO: I don't have --

CHAIRMAN ABDEL-KHALIK: Whether that needs to be verified by an actual test?

MR. CIOCCO: Let me see if we have any technical staff who wants to address the question.

MR. STUBBS: Good morning. My name is Angelo Stubbs. I'm the reviewer of the emergency feedwater system. And as far as verification by a test of the room temperature -- and this will be part of the station blackout coping -- in certain situations you have -- under station blackout equipment can -- that can be impacted by the environment, maybe by minimum temperature, control room --

CHAIRMAN ABDEL-KHALIK: We're talking about this specific case.

MR. STUBBS: For this specific case, if we see the evaluation, the analysis, and there is -- and they have conservatively done the analysis, I do not believe that we need to have it validated.

And I also don't think it's as simple as saying -- it's that simple to actually do, because we would still probably have to extrapolate your results to find out whether you meet the condition, because you -- to do this you would have to look at the assumptions made in terms of initial conditions, heat loads, the temperature surrounding rooms, and a lot of other things that you may not be able to duplicate exactly.

Unless they are taking a lot of credit for transfer of heat from one area to another area, through rooms, the heat capacity of the materials in the room, I don't think you would need to do that. I think just simply looking at an evaluation, looking at the heat load, and looking at the --

CHAIRMAN ABDEL-KHALIK: You are telling me you don't need a test, because the calculation is too complicated?

MR. STUBBS: No. I'm not saying that it's --

CHAIRMAN ABDEL-KHALIK: Is that what you're saying?

MR. STUBBS: No. I'm not saying you don't need to test it because the calculations are too complicated. I'm saying when you -- if you do a test and you get results, you probably will not test -- the test that is identical to what the calculation assumed, and you will have to adjust your results to find that out.

You could do a test and come in below, but because you are not in the condition that you would be in when the station blackout occurs, that will not necessarily mean that the station blackout will add -- that at the most limiting condition before the station blackout occurs will give you that same result.

CHAIRMAN ABDEL-KHALIK: Presumably, the calculation was done at the most limiting condition to show that --

MR. STUBBS: Correct.

CHAIRMAN ABDEL-KHALIK: -- you know, that you still have at least an hour.

MR. STUBBS: Right.

CHAIRMAN ABDEL-KHALIK: Couldn't you define an experiment in which you can actually duplicate the most limiting condition?

MEMBER SIEBER: You have to wait for a hot day I guess.

MR. HAMZEHEE: Let me just ask a question. Are you asking, is it required to do that test? Or are you asking, is it a good thing to do?

CHAIRMAN ABDEL-KHALIK: Is it contemplated? Is it a good thing to do? Is it necessary to do?

MR. HAMZEHEE: And I think -- correct me if I'm wrong -- I don't believe right now the staff thinks that this is a necessary thing to do. But if there is a reason -- and maybe the evaluation or analysis not sound -- then they may ask followup questions, and then also ask for any necessary testing. But at this time, I believe the staff did not find it necessary to perform the test.

CHAIRMAN ABDEL-KHALIK: Because they found the analysis to be conservative and adequate?

MR. STUBBS: No. I believe it's not necessary to do the performance test, because -- like when we do sub-compartment analysis, when we calculate long-term -- things for everything, a test would probably -- if we were to look at a test, it would be to validate some type of assumptions that they used that we're not completely sure are conservative, and their results are impacted by something that is either specific to how you actually do materials and design and/or because we don't have confidence in their evaluation.

MEMBER SIEBER: It would seem to me that any test that you would conduct would require an extrapolation to --

MR. STUBBS: Correct.

MEMBER SIEBER: -- to determine whether you meet the minimum capabilities that are required? Considering you really can't do a test at the right conditions.

MR. HAMZEHEE: That's correct.

CHAIRMAN ABDEL-KHALIK: Let me ask a question, then, of either the staff or the applicant. Let's say the turbine-driven aux feedwater pumps are operating, and you have AC power. How hot does it get in that room?

MEMBER SIEBER: You have AC power?

MR. STUBBS: We asked that question in an RAI, and their response was that they do not -- they stay below the 175 degree temperature F.

MR. HAMZEHEE: Are you talking about when you lose HVAC or while the HVAC is working?

CHAIRMAN ABDEL-KHALIK: While the HVAC is working. Everything is -- there is AC, you know, the aux feedwater pumps are running during a transient, and you still have AC. How hot does it get in that room?

MR. HAMZEHEE: MHI, do you have any answer for that? Maybe they should respond to this question. Under normal conditions, your HVAC is working, your turbine-driven pumps are running, what is the room temperature? Hopefully, it is below 100 degrees, but I don't know.

MR. SAMAMOTO: We cannot answer now. We

need to confirm.

CHAIRMAN ABDEL-KHALIK: Okay. So the followup question, then, you have a situation in which the turbine-driven aux feedwater pumps are running. You have AC power, and you reach that relatively high temperature, which I suspect will be much higher than 122 degrees F, the 50 degrees C, that he is talking about.

If that is the case, if you were to lose AC at that point, would you still be able to restart the pumps after an hour?

MR. STUBBS: I don't understand the question that you're asking.

MR. HAMZEHEE: I think this is a different situation. Your turbine-driven pump is running, your HVAC is working. And then, as the temperature in the room goes up, at some point you lose AC power. So now he wants to know how fast the room is going to heat up, because you are already at a high level and you may reach that limiting condition very quickly.

CHAIRMAN ABDEL-KHALIK: You may not be able to restart those pumps at all.

MR. STUBBS: I'm still not clear exactly what you are talking about. If you have AC power initially, and you also have the electric-driven motor

-- motor-driven pumps, are you talking about you lose the -- if you have AC power, you have the motor-driven pumps. Are you talking about after the pumps restart?

MR. HAMZEHEE: I think let me clarify the scenario. You have -- for some reason you are in an accident condition, your turbine-driven pump starts, and your HVAC room cooling is working. At some point in time, you lose AC power. So your motor-driven pumps are not going to work anymore. Now you have to restart your turbine-driven pump.

I think he want to know, at that point, since you are under different environmental condition, how fast do you reach the temperature? Number one. Number two, can you restart the turbine-driven pump?

CHAIRMAN ABDEL-KHALIK: Ever.

MR. HAMZEHEE: I think that's the question. Am I right?

CHAIRMAN ABDEL-KHALIK: Yes.

MR. STUBBS: MHI will have to answer that question.

MEMBER-AT-LARGE STETKAR: If you're answering, you have to come up and state your name and speak at the microphone.

MR. SEGALA: Yes. This is John Segala from the staff. I'm the Chief of the Balance of Plant

Branch. You know, the HVAC system or the coolers for that room are designed for the accident heat load, so that will be designed to maintain the temperature of that compartment or that room. That is -- you know, the people that would do that review, that would be more of a Chapter 6 review, Chapter 9, Chapter 6.

But that would be, I assume, the initial conditions for the analysis that was performed in the scenario that they did the heatup calc for.

CHAIRMAN ABDEL-KHALIK: Well, that -- is that the case?

MR. HAMZEHEE: Does MHI want to shed any information on this?

MR. KAWANAGO: This is Shinji Kawanago from MNES again. And the basis of the calculation of the temperature is that it is -- there's minimum temperature and maximum temperature for the calculation. And the starting point of the increased temperature, we use a maximum temperature.

And this is -- for example, the starting out turbine driven, auxiliary feedwater pump, it's -- if there is AC power, in that case, ventilation system is operating. So the -- and room temperature controlled between the maximum -- minimum and the maximum, okay?

So if there is a failure in the ventilation system because of the failure of the emergency power supply system, and we calculate it from the start, from the maximum temperature, and within one hour, and that temperature were not beyond the design temperature limitation, and if -- and URL, I would like to correct my answer.

I answered to you that 50 degrees C is a design limitation, but actually the -- it is my misunderstanding. I am so sorry. It is conditions 80 degrees C. That is limiting condition. So then, we calculate from the maximum normal temperature to the design limit. And the reason is there is no increase.

CHAIRMAN ABDEL-KHALIK: So the 50 degrees C is the normal temperature in the room when the pumps are operating?

MR. KAWANAGO: It's --

CHAIRMAN ABDEL-KHALIK: With HVAC?

MR. KAWANAGO: Normal is -- maximum is 105 degrees and --

CHAIRMAN ABDEL-KHALIK: And the limiting temperature is 180 degrees F, or 80 degrees C, you said?

MEMBER BLEY: That's what he said.

MR. KAWANAGO: 175 --

CHAIRMAN ABDEL-KHALIK: 175.

MR. KAWANAGO: -- degrees Fahrenheit.

CHAIRMAN ABDEL-KHALIK: Okay. So if for some reason the operators need to start these pumps manually during that time period, how would they get there if the temperature is somewhere close to 175 F, or try to control the pumps manually?

MR. KAWANAGO: Sorry, but I cannot understand. What is the starting condition? Is it station blackout and without AC power?

CHAIRMAN ABDEL-KHALIK: Right. And you are -- during that heatup period, and for some reason you need to control flow.

MR. HAMZEHEE: If you remember, maybe that's why MHI -- correct me if I'm wrong -- did not credit it manual initiation or control. Remember, that's what they mentioned earlier in their presentation.

Now, they said it's feasible, but they did not take credit for it.

CHAIRMAN ABDEL-KHALIK: Okay. I think we will have to revisit this when we talk later on. I don't know where would be the appropriate chapter to talk about this. John?

MEMBER-AT-LARGE STETKAR: Yes. That's -- well, it -- we're tracking it. It's probably an issue for Chapter 19, because that's eventually where everything comes together. It might be Chapter 9, which is ventilation systems designs. It might be Chapter 6, as you mentioned. But my suspicion is Chapter 19. It will --

MR. HAMZEHEE: And I think as a general comment -- I hope it helps -- that as they do these analyses, and once they define what the upper design limit is, then by regulation they are required to demonstrate, as part of the equipment qualification, that all of these necessary components can function up to that temperature. So --

CHAIRMAN ABDEL-KHALIK: Thank you.

MEMBER REMPE: Before we leave this, can we repeat what the temperatures were? Because they kept switching.

MEMBER-AT-LARGE STETKAR: What is -- for MHI, just for the record, for clarity, which is the design qualification temperature for the equipment in the turbine-driven emergency feedwater pump room?

MR. KAWANAGO: We answered to you, basically, the design limitation is 80 degrees.

MEMBER-AT-LARGE STETKAR: Eighty degrees

C.

MR. KAWANAGO: So that is an equipment requirement.

MEMBER-AT-LARGE STETKAR: Okay. Eighty degrees C.

MR. HAMZEHEE: Close to 175 F?

MEMBER-AT-LARGE STETKAR: I just wanted to make sure we had it, because there were a few different numbers floating around, and now we have it on the record.

MR. HAMZEHEE: And I think, John, as part of your question last time, I believe MHI is going to provide some heatup calculations, so that you can see the design distribution.

MEMBER-AT-LARGE STETKAR: Essentially, in the Subcommittee meeting we requested the actual room heatup curves, not only to see what the calculations showed, to confirm the survivability for the first hour, but also past the first hour to see where -- if you get to a steady-state temperature, what it is; if you don't, when you reach, you know, greater than 80 degrees C or whatever the qualification temperature is.

With that --

MR. CIOCCO: Well, then, finally we had

what we talked about earlier, what we consider one of our technical challenges was the US-APWR uses the gas turbine generators in lieu of the commonly used diesel generators. We talked about the first-of-a-kind application as a Class 1E source. Therefore, the operating experience has been limited to the non-nuclear applications.

In our Phase 2 review, the reliability and the seismic qualification was an open item, and we did go ahead and move forward, because we had very adequate test plans for the reliability testing and the seismic qualification of the gas turbine generators.

As we heard earlier, MHI has completed its initial type testing program. We just got Revision 2 of the technical report. We will make that available to the ACRS as well once that gets processed into our system and on the docket. It did address the reliability and the seismic qualification testing.

We are currently reviewing the results of both of those tests. It is going to be addressed in Phase 4, and the seismic qualification is really handled in Chapter 3 -- I think it's Section 3.3.10 -- or we look at the seismic qualification. And so that will be down the road whenever we see the seismic qualification in Chapter 3.

MEMBER SIEBER: I have a question. Typically, the gas turbine generators that have -- the turbine part of it operates at a relatively high speed compared to the generator. You may have a generator at 1,800 rpm, you may have a turbine running at 4,800 rpm, you want to start that from zero cold to 4,800 rpm hot in 90 seconds, something like that, which puts a lot of strain on the blades, by the way.

When you're running the seismic test, do you run it with the unit shutdown or operating? Because clearance interference when it's shut down will not result in the failure of the turbine. On the other hand, clearance interference when it's running, you may have blade rubs, blade vibrations, which cause failure. So which way do you do that, and how do you justify the occurrence of a seismic event while the gas turbine generator is already started and running?

MR. CIOCCO: Is that an MHI -- we're just looking at the results right now. The testing --

MEMBER-AT-LARGE STETKAR: We saw that -- I don't recall -- the video that they presented, I don't recall whether the gas turbine was operating or whether it was --

VICE CHAIRMAN ARMIJO: I thought it was

operating.

MEMBER-AT-LARGE STETKAR: I don't recall it operating, but I'd like to hear that from MHI.

MR. KAWANAGO: This is Shinji Kawanago from MNES. We conducted several test conditions, and one is -- at first, in shaking a table and gas turbine generator and don't start and starting -- and push starting and aborting and a gas turbine generator starting.

And the other mode is in a gas turbine generator have already started. And after that, shaking a table.

MEMBER BLEY: Was it fully loaded?

MR. KAWANAGO: Yes, it's fully loaded.

MEMBER SIEBER: Okay. So it is operating when you do the test.

MR. KAWANAGO: I'm sorry. I'm sorry. It was without.

MEMBER SHACK: You ran it two ways -- one when it started the shaking, and then started the generator; and the other one while it was running, and they started it.

MEMBER SIEBER: That satisfies my concern. Thank you.

MR. KAWANAGO: You're welcome.

VICE CHAIRMAN ARMIJO: Just a quick question. I may have asked this before in one of the Subcommittee meetings. In the -- will the first application of the gas turbine generator be in, let's say, a plant in Japan that may be under construction? I don't know. Or will it be the first application in a U.S. --

MEMBER BLEY: Are they even running anywhere?

VICE CHAIRMAN ARMIJO: Well, they say at non-nuclear --

MEMBER BLEY: Sure.

VICE CHAIRMAN ARMIJO: -- but in a nuclear plant, is there plans to build and operate this type of plant in Japan?

MR. CIOCCO: I think MHI will answer.

MR. KAWANAGO: I'm Shinji Kawanago. When we talk about the commercial nuclear -- commercial nuclear powerplant, including Japan, this is a first application. However, in Japan, we had an application for the gas turbine generator to the -- in a nuclear powerplant. But that is actually the commercial -- commercial nuclear powerplant. It's a test nuclear powerplant in Japan. So this is including just an experiment, and this one is second application.

VICE CHAIRMAN ARMIJO: What was that plant, the test plant?

MR. KAWANAGO: It's actually the Tolkai. It's Tolkai -- I'm sorry, I don't remember the actual name. And also, and when we talk about recycled fuel, we have already applied the gas turbine generator. So the -- if we tell all this in a -- you expand the scope of the nuclear-related facility, we have already applied to gas turbine as a safety -- as the safety -- as safety and emergency power supply system.

VICE CHAIRMAN ARMIJO: Okay. Thank you.

MR. CIOCCO: That concludes my presentation this morning.

MEMBER-AT-LARGE STETKAR: Do Committee members have any other questions for the staff? Comments?

(No response.)

Nothing. Jeff, thank you very, very much. Appreciate it. Thank you.

Do we have any questions or comments from any members of the public?

(No response.)

If not, I would like to thank both MHI and the staff for presentations and fielding our questions. And, Mr. Chairman, I will turn it back to you.

CHAIRMAN ABDEL-KHALIK: Thank you. We are half an hour early. But at this time, we are off the record. We will take a 15-minute break. We will -- at that -- when we return, we will pick up the next item on the agenda, which is the P&P report. We will reconvene at 10:15.

(Whereupon, at 10:00 a.m., the proceedings in the foregoing matter went off the record.)

US-APWR

Design Certification Application

Chapter 2, 5, 8, 10, 11, 12, 13, 16

ACRS Full Committee Presentation

September 9, 2011

Mitsubishi Heavy Industries, Ltd.

Introduction

- The US-APWR basic design concept is the same as conventional 4 loops PWR plant.
- Significant unique features of US-APWR are as follows:
  - Advanced Accumulator – future discussion as part of Chapter 6
  - Digital I&C Platform – future discussion as part of Chapter 7
  - Emergency Gas Turbine Generator (GTG) – discussion included as part of Chapter 8

Chapter 2: Site Characteristics

- Geological, Seismological, Hydrological and Meteorological parameters are addressed.
- COLAs confirm site characteristics are bounded, or provide site-specific qualification.
- No issues to be discussed.

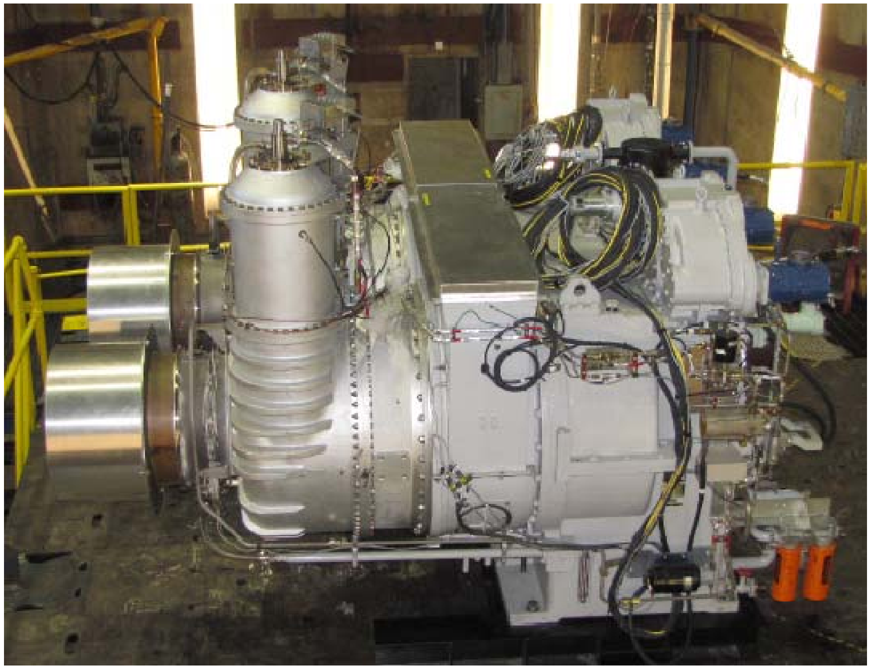
Chapter 5: Reactor Coolant and Connecting Systems

- Addresses the integrity of the Reactor Coolant Pressure Boundary, which consists of the Reactor Vessel, Reactor Coolant Pumps, Steam Generators and Subsystems.
- No issues to be discussed.

Chapter 8: Electric Power

- Offsite Power System, Onsite Power Systems, AC Power Systems, DC Power Systems and Station Blackout are addressed.
- Class 1E GTGs are applied as the emergency power source.

Chapter 8: Electric Power (Continued)



- Specification for GTG
  - ✓ Class 1E, Seismic Category I
  - ✓ Rated Output: 4500 kW
  - ✓ Starting time: less than 40 sec.
  - ✓ Starting System: air
- MHI performed qualification tests (initial type tests and seismic tests) based on IEEE 387-1995.

Chapter 8: Electric Power (Continued)

- **Qualification Tests**
  - ✓ **Initial Type Tests (Sep. to Dec. 2010)**
    - **Load Capability Test, Start and Load Acceptance Test, and Margin Test**
    - **Test results are shown in the Technical Report MUAP-10023 R2.**
  - ✓ **Seismic Tests of Gas Turbine Engine (Mar. to Apr. 2011)**
    - **Testing consists of 5 OBE and 2 SSE tests using the DCD Required Response Spectra (RRS).**
    - **Test results are shown in the Technical Report MUAP-10023 R2.**
- **Major RAIs**
  - ✓ **Reliability: MHI has reported reliability evaluation details in the Technical Report MUAP-10023 R2.**
  - ✓ **Diversity: MHI has committed to use different manufacturers for the Class 1E GTGs and the AAC-GTGs.**

Chapter 10:
Steam and Power Conversion System

- Turbine Generator, Steam and Power Conversion Systems are addressed.
- No issues to be discussed.

Chapter 11:
Radioactive Waste Management

- Liquid, Gaseous and Solid Waste Management Systems are addressed.
- No issues to be discussed.

Chapter 12: Radiation Protection

- Radiation Sources, Radiation Protection Design Features and Dose Assessment are addressed.
- No issues to be discussed.

Chapter 13: Conduct of Operations

- Information relating to the preparation and plans for the US-APWR plant design, construction, and operation are addressed.
- No open items and no issues to be discussed.

Chapter 16: Technical Specifications

- Safety limits, limiting safety system settings, LCOs (Limiting Conditions for Operation), surveillance requirements, design features and administrative controls are addressed.
- No issues to be discussed.

Thank You

MITSUBISHI HEAVY INDUSTRIES, LTD.

U.S.NRC

United States Nuclear Regulatory Commission

Protecting People and the Environment

Presentation to the ACRS Full Committee – 586th Meeting

US-APWR Design Certification Application

Safety Evaluation Report with Open Items for Chapters 2, 5, 8, 10, 11, 12, 13, and 16

Jeffrey Ciocco
US-APWR Design Certification Lead Project Manager

September 9, 2011

Agenda

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

- US-APWR Design Certification licensing overview.
- Summary of Safety Evaluation Reports (SER) with Open Items.
- Summary of Technical Challenges.

US-APWR Design Certification Major Milestones Chronology

DATE	ACTION
07/13/2006	Pre-application activities began
12/31/2007	Design Certification Application Submitted
02/29/2008	Application accepted for review (docketed)
08/29/2008	Design Control Document Revision 1 submitted
06/19/2009	Phase 1 review completed
10/27/2009	Design Control Document Revision 2 submitted
May 2010 – August 2011	Phase 2 and Phase 3 reviews completed for Chapters 2, 5, 8, 10, 11, 12, 13, and 16.
03/31/2011	Design Control Document Revision 3 submitted

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US-APWR Design Certification Review Schedule

TASK DESCRIPTION	COMPLETION DATE
Phase 1 – Preliminary Safety Evaluation Report (SER)	Completed
Phase 2 – SER with Open Items	January 2012
Phase 3 – ACRS Review of SER with Open Items	May 2012
Phase 4 – Advanced SER with No Open Items	October 2012
Phase 5 – ACRS Review of Advanced SER with No Open Items	January 2013
Phase 6 – Final SER with No Open Items	May 2013
Rulemaking	October 2013

Summary of Chapters 2, 5, 8, 10, 11, 12, 13, 16 SER with Open Items

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- To-date, eight SERs with Open Items for Chapters 2, 5, 8, 10, 11, 12, 13, and 16 have been issued and presented to the US-APWR ACRS Subcommittee.
- The staff issued many RAIs questions which resulted in a number of Open Items.
- There are no significant technical issues.

Summary of Technical Challenges Chapter 8 Electric Power

- The US-APWR uses Gas Turbine Generators (GTGs), as Emergency Power Supply in lieu of the commonly used Diesel Generators.
- This is a first-of-a-kind application of GTG to Class 1E sources in nuclear plants, therefore the operating experience is limited to non-nuclear applications.
- Two issues related to the GTG are the reliability and seismic qualification.

Summary of Technical Challenges Chapter 8 Electric Power (cont'd)

U.S.NRC
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- MHI has completed the Initial Type Test Program for the GTG reliability and the seismic qualification testing.
- NRC staff is currently reviewing the results of the Initial Type Test Program.
- GTG reliability will be addressed in Phase 4 of the Chapter 8 review.
- GTG seismic qualification will be addressed in Chapter 3.