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NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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US-APWR SUBCOMMITTEE

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TUESDAY

SEPTEMBER 17, 2013

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ROCKVILLE, MARYLAND

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The Subcommittee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B1, 11545 Rockville Pike, at 8:30 a.m., JOHN W. STETKAR, Chairman, presiding.

COMMITTEE MEMBERS:

JOHN W. STETKAR, Chairman

SANJOY BANERJEE, Member

DENNIS C. BLEY, Member

CHARLES H. BROWN, JR. Member

JOY REMPE, Member

MICHAEL T. RYAN, Member

STEPHEN P. SCHULTZ, Member

DESIGNATED FEDERAL OFFICIAL:

GIRIJA SHUKLA

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P R O C E E D I N G S

8:30 a.m.

CHAIRMAN STETKAR: The meeting will now come to order. This is a meeting of the United States Advanced Pressurized Water Reactor Subcommittee. I am John Stetkar, chairman of the subcommittee meeting.

ACRS members either in attendance or to be here are Sanjoy Banerjee, Dennis Bley, Steve Schultz, Mike Ryan, Charlie Brown, and Joy Rempe.

Mr. Girja Shukla, the ACRS staff is the Designated Federal Official for this meeting.

The Subcommittee will discuss the US-APWR design certification document and Comanche Peak combined license application; Chapter 6, Engineered Safety Features; topic report, MUAP-07001, the Advanced Accumulator; and the staff's Safety Evaluation Reports associated with these documents.

We will hear presentations from Mitsubishi Heavy Industries, Mitsubishi Nuclear Energy Systems, Luminant Generation Company, and the NRC staff.

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

The rules for participation in today's

meeting have been announced as part of the notice of this meeting previously published in the Federal Register.

Parts of this meeting may need to be closed to the public to protect information proprietary to Mitsubishi Heavy Industries or MNES or other parties. I'm asking the NRC staff and the Applicant to identify the need for closing the meeting before we enter into such discussions and to verify that only people with the required clearance and need to know are present. So again, just keep track of the discussion. If we veer into proprietary information either ask us to hold a question or we'll accumulate things at the appropriate time and close the meeting. So I'll ask you to keep track of that because I'm not very sensitive to those things.

A transcript of the meeting is being kept and it will be made available as stated in the Federal Register notice. Therefore, we request that participants in this meeting use the microphones located throughout the meeting room when addressing the Subcommittee. The participants should first identify themselves and speak with sufficient clarity and volume so that they may be readily heard. A telephone bridge line has also been established for this meeting. To

preclude interruption of the meeting, the phone will be placed on the listen in mode during the presentations and committee discussions.

Please silence your cell phones or whatever else makes noise and we will now proceed with the meeting. I've heard that we now have a new project manager and so I'll ask the NRC staff, Perry Buckberg to open the meeting.

MR. BUCKBERG: Thanks, John. My name is Perry Buckberg. I took over as the lead for the DCD last Monday night of September and I'll give a little background of the status of the project as I know it. Thirteen chapters have been through the full Committee, the Subcommittee and then full Committee at this point. Chapter 6 and most design centers usually has some complicated issues and it's usually one of the later chapters to be issued and for the ACRS to discuss and that's where we are this morning.

Just a general summary, I guess, and any specific discussions about Chapter 6 I'll turn it over to Chapter 6 PM Ruth Reyes and we appreciate the opportunity to brief ACRS this morning.

CHAIRMAN STETKAR: Thanks, Perry.

Ruth, do you have anything to say? That was quite. With that, Ryan?

MR. SPRENGEL: Good morning, everyone, this is Ryan Sprengel with MNES. Good to see everyone again. It's been a little break, but I think we have a busy close out to the year.

CHAIRMAN STETKAR: We'll be seeing a lot of each other in the next two or three months.

MR. SPRENGEL: As usually, we'll provide any follow ups following the meeting if we're not able to provide responses during the meeting. I think we work well with the ACRS members on those follow-up items and with that brief introduction, I'll go and turn it over to Rebecca Steinman to start the presentation.

CHAIRMAN STETKAR: One of the things that I did want to mention, I think we're all aware that we have a meeting scheduled on October 1st, in particular for the GSI-191 related issues for long-term cooling. So what I'd like to do in this meeting and GSI-191 strainer blockage, downstream effects, are all related to Chapter 6, but if it's possible we can delve into some of those issues, in particular debris accumulation, strainer blockage, downstream effects to some extent in this meeting, but I'd like to reserve a lot of the detailed discussion of those topics for the October 1st meeting if at all possible.

So this is just a forewarning, if I see the

discussion getting into too much detail about strainer testing or debris accumulation, either on the sump strainers themselves or the downstream effects, I'm going to try to hold that level of discussion down and postpone it for October 1st a little bit.

MR. SPRENGEL: We definitely agree with you.

CHAIRMAN STETKAR: Excellent. I'm glad we're on the same page. That was just a forewarning. I don't want to quell discussion too much, but I do want to avoid unnecessary repetition of information and I want to make sure that on October 1st we have a complete picture, essentially, of the debris transport from wherever it's generated all the way to whatever makes it to the field.

MS. REYES: John, this is Ruth Reyes, Chapter PM. For the same reason in our previous dry runs in meetings to prepare for this meeting, we make sure that in the NRC staff presentation there's nothing related to GSI-191.

CHAIRMAN STETKAR: Good.

MS. REYES: And in MHI --if there's something, it will be very minimal.

CHAIRMAN STETKAR: Out of curiosity, just so I organize my thoughts and perhaps understand a little

bit how to control the meeting, is MHI and the staff going to discuss net positive suction head issues in this meeting?

MS. STEINMAN: Our intent is to provide that information in the October meeting.

CHAIRMAN STETKAR: In the October meeting.

MS. STEINMAN: If it's necessary to discuss it today, we have prepared backup materials for that purpose, but it is not part of the main presentation.

CHAIRMAN STETKAR: That's fine, we need to discuss at some point --

MS. STEINMAN: Our intention is to do that in October.

CHAIRMAN STETKAR: It's different, but related to the debris transport issue, so we'll also try to table the detailed discussions on net positive suction head, containment accident pressure, and those types of issues for the October meeting. Good, thank you. That helps.

MEMBER BANERJEE: Just, just a point for clarification. Will we discuss long-term cooling at the October 1st meeting or what's the intention of it? Is it just GSI-191? There are issues associated with long-term cooling.

CHAIRMAN STETKAR: Yes, I think, Sanjoy,

we'll have a full day with just GSI-191, especially if we include the pump suction head issue, so I think that aspect of long-term cooling will try to cover all of those issues in the October meeting. Other concerns, I know that you have, are probably more relevant to bring up in this meeting.

MEMBER BANERJEE: The thing about boron --

CHAIRMAN STETKAR: It's difficult because of the pervasive nature of the issue of long-term cooling and all of the different factors that fold into it. There's thermohydraulic analyses, there's LOCA analyses, there's issues of debris, many, many different issues. And --

MS. REYES: It's my understanding there were some topics related to long-term cooling in Chapter 15 that were already discussed at the Chapter 15 ACRS meeting.

CHAIRMAN STETKAR: That's I think --

MS. REYES: If there's something that the staff wants to hear again, please let us know and we can incorporate that into our presentation.

CHAIRMAN STETKAR: Okay, let's do it that way. Raise the questions, anything that's not related -- it sounds like the staff and MHI are planning to cover NPSH containment accident pressure and all things

related to debris transport, strainer plugging downstream effects in that meeting in October. If there are other issues that --

MEMBER BANERJEE: Bring it up at the end of this meeting.

CHAIRMAN STETKAR: Bring it up at the end of this meeting so we sort of alert people to it.

MEMBER BANERJEE: Because I think I have certain concerns which we brought up in Chapter 15.

CHAIRMAN STETKAR: That's right, there are Chapter 15-related concerns, so you're right.

MEMBER BANERJEE: One of them dealt with the long-term cooling --

MS. REYES: I know that in our presentation we are going to be including bottom precipitation which is Chapter 15 on this long-term cooling. So that will on October 1st.

CHAIRMAN STETKAR: Let's just see how it goes. I'm just trying to figure out so we don't miss anything between the two meetings and we don't have too much duplicative discussion of specific issues, especially as you all know, we tend to get into details.

All right, well, with that, thanks Rebecca.

MS. STEINMAN: Thank you very much. Good morning. This presentation is for the DCD Chapter 6

which covers the engineered safety features for the USA-PWR design.

Next slide, please.

My name Rebecca Steinman and I am the licensing engineer responsible for Chapter 6 and I will be the lead presenter this morning. However, I have brought excellent technical support with me to aid in answering your questions. This support includes Takafumi Ogino, Naohiko Seto, Mark Biery, Hiroshi Hamamoto and, of course, Ryan Sprengl, who you have met already.

Next slide, please.

The next several slides in today's presentation are just a list of acronyms. I don't intend to spend any time on these, but they are provided for your reference during the presentation.

Mark, if you could be so kind as to fast forward past those, it would be appreciated.

Here we see an overview of the six main sections of the DCD. In Section 6.0, we have an overview of the engineered safety features. In 6.1, we have the material specifications associated with the ESFs. 6.2 covers the containment systems. 6.3 covers the emergency core cooling systems. 6.4, the habitability systems. 6.5, fission product removal and control

systems. And 6.6, the ISI Class 2 and Class 3 components.

The remainder of this presentation will discuss each of these sections individually and point out those features of the US-APWR that are essentially the same as other operating plants, as well as features that are unique to the US-APWR design. At the end of each section, I will summarize the open items remaining under the review area and briefly outline the intended closure path of each item from MHI's perspective.

As a brief side note, for GSI-191, you are aware that we are having another meeting and as a result, the open items that are related to that topic are not going to be discussed in today's presentation. They're briefly listed as to what the topic is, but that's the only level of detail that we were intending to provide today and the detailed discussion would be provided on October 1st.

CHAIRMAN STETKAR: And again, I'll ask if you think because some of the topics are interrelated, if you think we're getting into a line of questioning that delves more toward what you're planning to cover in October, just alert us to that. We'll tick off a box and save the question for that.

Before you flip the slide over, I had a

question and just for my understanding, we, the ACRS Subcommittee, currently have Revision 3 of the DCD. We also have various revisions of a number of supporting technical reports. I understand that some features of the plant design have changed since DCD Revision 3 was issued that affect some of the long-term cooling issues and basic water flows and some configurations inside the containment, RWSP, and so forth.

If I look at the technical reports, for example, MUAP-08001, that report seems to be written, at least the version that we have to the what I'll call perhaps dangerously the current design or as DCD Revision 3 seems to be written to the old design.

What information are you going to present today?

MS. STEINMAN: The staff's SE was written against DCD Rev. 3.

CHAIRMAN STETKAR: That's not clear either. I was going to ask the staff after I ask you.

(Laughter.)

MS. STEINMAN: It is written against that. There have been several RAIs that incorporate various changes to the DCD. We recently submitted DCD Rev. 4 to the staff, but it was very recent and not in time to be processed in preparation for this meeting. The

primary changes that you're talking about are in DCD Rev. 4 and they are going to be the focus of much of our GSI-191 presentation on October 1st so that that design change is predominantly going to be discussed as part of that meeting and the materials that are going to be described today as part of the Chapter 6 presentation are items that had I would say minimal changes related to them as a result of the RAI process and review process between Rev. 3 and Rev. 4 of the DCD.

So in terms of the redesign of the flow path for the recirculating water and things along those lines, that is primarily going to be focused on as part of the GSI-191 presentation next month.

MEMBER BANERJEE: So the --

CHAIRMAN STETKAR: I have a bit of a problem, hold on a second, Sanjoy?

MEMBER BANERJEE: Yes.

CHAIRMAN STETKAR: I have a bit of a problem because it is now by my watch September 17th and the meeting is October 1st. That's, I believe, something on the order of two and a half weeks or something like that. We normally like to receive information about 30 days in advance of our meetings because we're kind of busy people and we're kind of only half-time people.

So we don't have time to process Rev. 4 of the DCD in the next two weeks.

MS. REYES: Yes. We didn't have Rev. 4 30 days before this meeting, but I have provided the latest revision of the technical reports related to GSI-181.

CHAIRMAN STETKAR: Right, we do have those. We received those whenever it was, a couple of weeks ago. So those were in place for 30 days. So I guess we'll organize our discussions around those technical reports because I know they do include the latest design.

MS. STEINMAN: The technical reports were revised in June of this year and they do reflect the latest design. And if you have access to the tracking reports that we provide for the DCD, those incorporate that information into the DCD, but it kind of requires a little bit of looking at multiple documents.

CHAIRMAN STETKAR: Rebecca, if you saw the thousands of pages, literally thousands of pages of material that we each receive each week, we don't want more.

(Laughter.)

MS. STEINMAN: I don't blame you there. I completely understand.

MEMBER BLEY: That said, do get us Rev. 4s.

CHAIRMAN STETKAR: As soon as we can get

it.

MEMBER BANERJEE: So just for clarification, the flow path discussion in the SE, staff SE, refers to Rev. 3 or is it Rev. 4?

MS. REYES: The SE was written based on Rev. 3. Rev. 4 was like two weeks ago I think it was submitted, so I will like if it's possible that the staff -- has not been submitted yet because we still have to do the proper dissemination of the DCDs. Staff doesn't even have these Rev. 4 of the DCD yet.

MEMBER BANERJEE: So whatever discussion on flow paths there is in your SE refers to Rev. 3?

MS. REYES: That is GSI-191 and for GSI-191, I have provided the latest reports which have incorporated the changes.

MR. SPRENGEL: Can we clarify that the staff's SE is written on Rev. 3 and are our responses and committed changes?

CHAIRMAN STETKAR: That was my --

MR. SPRENGEL: The SER is actually written to what we would call the current design.

CHAIRMAN STETKAR: That was my understanding because as I read through the SER, it seemed to describe flow-path configurations that are consistent with, for example, the information in Rev.

-- hold on a second, 7 of MUAP-08001 which is the current design. Now whether that was elicited through RAIs, I'm not sure, but --

MR. SPRENGEL: Which it was.

CHAIRMAN STETKAR: But for example, both the flow-path configuration for the recirculating water, the configuration of the sodium pentaborate, sodium tetra -- whatever the heck, NETB drain lines and things like that. The current configuration seems to be reflected in the version of the SER that we have, not the old configuration.

I'm just curious because I have questions about trying to orient myself to what we are reviewing and commenting on versus what the staff SER addresses versus what we may hear about today versus what we may hear about in two weeks. And again, I don't want to miss things that might be pertinent, and I don't want to discuss the same issue twice.

MS. REYES: As Ryan was explaining, on the SEs, it's based on Rev. 3, but it also incorporates responses from the staff's RAI. So like this change, this specific change in the RWSB flow path was -- these changes and the FP because it's based on our RAI response.

CHAIRMAN STETKAR: Okay.

MEMBER BANERJEE: For example, things like ineffective volume and so on are reflected in your SER, is the correct values that you're using, the revised values?

CHAIRMAN STETKAR: The current values. I believe that's true. But the reason I ask is because I had some questions about volumes and hold-up volumes and RWSP volumes and things like that, based on my understanding of the current design.

MR. BUCKBERG: If I may, another approach to this is that the SER is written to DCD Rev. 3 and the design, if I may, evolves from that point on through RAI responses and technical reports. Whatever is referenced in the SER, those RAI responses and technical reports is what the SE is based on and what the subject of this meeting should be.

DCD Rev. 4, when it's through processing at the NRC at the Document Control Desk, will capture perhaps most of those technical reports and RAI responses and incorporate those changes into the document, but we're in a point in between right now and that SE captures a certain point in time and that's the subject of the discussion today.

CHAIRMAN STETKAR: I'm just trying to pin down what the point and time is because as I read the

SE, the SE also seems to be between. Although it says Rev. 3 there are words and numerical values and conclusions in the version of the SE that we have. It seemed to be derived from that later information.

MR. BUCKBERG: Later information that should be in a letter that's referenced by date in the SE I would think, RAI responses.

CHAIRMAN STETKAR: RAI responses.

MR. BUCKBERG: Right, right.

CHAIRMAN STETKAR: Anyway, let's play it by ear. I'm going to ask my questions, for example, based on my understanding of the current design. Be a little bit careful because the October 1st meeting is one day and we have a lot of material to cover in that one day. I don't want to necessarily postpone too many things to say we'll discuss them on October 1st unless we all bring mattresses because I don't want to go until midnight that day.

Let's do that. I think that helps a little --

MEMBER BANERJEE: If we get too stuck with volumes and flow paths and stuff on October 1st, we're never going to get down to the real thing.

CHAIRMAN STETKAR: That's exactly right. I mean --

MEMBER BANERJEE: We'll try to cover as much as we can today.

CHAIRMAN STETKAR: Right.

MEMBER BANERJEE: Or tomorrow.

CHAIRMAN STETKAR: Right. And you know, for reference, this is our first meeting on these topics. We will have another chance to revisit DCD Chapter 6 during -- I always forget the phases, 4, 5, whatever it is of our review when the final SER is written. We have that opportunity to tie up loose ends, but I want to make sure that if we do have any particular concerns at this point in time we have the opportunity to discuss those concerns with both MHI and the staff.

MEMBER BANERJEE: So when is Rev. 4 going to be available?

CHAIRMAN STETKAR: Tomorrow. We're going to get it tomorrow.

MR. BUCKBERG: It's being processed and docketed right now. It's a huge document with many different files and it's just taking some time to do. We have to wait. It's not on our website or available to the public or to the staff just yet because it's just taking time. It could be tomorrow.

CHAIRMAN STETKAR: Could we get it by the end of the week?

MR. BUCKBERG: Seems reasonable, I would think, but I'm not sure. Some of these things take ten days or so to process.

CHAIRMAN STETKAR: You get the notion that haste is important because we would really like to avoid this type of discussion on October 1st, if at all possible.

MR. BUCKBERG: Understood.

CHAIRMAN STETKAR: Okay, let's continue because we'll be here until midnight tonight if I don't let you folks address what you plan to address.

MS. STEINMAN: The first section of DCD Chapter 6 provides an overview of the four main ESF systems for the US-APWR. These include the containment system which involves heat removal, isolation, and hydrogen monitoring and control systems; the ECCS which covers the accumulate, the high-head injection, and the emergency letdown; the habitability systems which cover systems such as the main control or main check system; and the fission product removal and control systems.

The design information associated with these ESFs is discussed in greater detail in subsequent sections of the DCD and as a result, no RAIs were issued for this overview level section of the DCD.

Next slide, please.

This slide provides an outline of DCD Section 6.1 which provides information on the material section and fabrication of the ESF systems. In addition to other important attributes, the materials used in the ESF systems are selected for compatibility with the refueling water storage pit water as well as the spray conditions that result from the combination of the refueling water storage pit fluid with sodium tetraborate decahydrate in the event of a design basis accident.

Let's go ahead and begin with an overview of the metallic material specifications. The US-APWR components are designed and manufactured in accordance with the ASME Boiler and Pressure Vessel Code 2001 edition for 2003 addenda. The material specifications for the pressure retaining materials in the ESF systems are the same as those used for the reactor coolant boundary piping and valves as specified in DCD Section 5.3.2.

In accordance with ASME Code Section 3, Articles NC2160 and NC3120, austenitic stainless steel is used for compatibility with the environment that the materials are going to be exposed to.

Next slide, please.

DCD Table 6.1-1 summarizes the material

specifications for pressure-retaining materials of the PCCB and other ESF systems that are not part of the reactor coolant boundary. This table summarizes the material type as well as the specific grade of material that is required for each of the components. Similarly, DCD Table 6.1-2 provides material specifications for components that will be exposed to the reactor coolant or containment spray.

The RWSP water is borated to approximately 4,000 PPM boric acid at a pH of approximately 4.3. Crystalline NaTB is stored in baskets inside containment and is used to raise the pH of the RWSP water from 4.3 to at least 7 in post-LOCA conditions. This pH is consistent with the guidance for the protection of austenitic stainless steel from chloride-induced stress corrosion cracking.

Next slide, please.

There are no open items related to DCD Section 6.1.1 for the metallic material specifications in the DCD.

Let's go on and move ahead to the organic material specifications.

With the notable exception of coatings and electrical insulation, organic materials are not freely available in containment. All organic materials that

exist in significant amounts in the containment are identified and quantified in Section 6.2.2.3 of the DCD.

In rare cases when coatings do need to be used inside containment, they are applied in accordance with Reg. Guide 1.54 and meet the applicable environmental qualification requirements that are described in Section 3.11 of the DCD which is for the EQ program.

There are no open items for DCD Section 6.1.2 related to the organic material specifications.

This slide provides an overview of the containment system section of the DCD. The containment system section of the DCD describes the physical attributes of the reactor containment and how these physical attributes address and satisfy the containment functional design requirements. On the next slides, we'll be walking through each of the containment sections including the containment functional design, the heat removal systems, the secondary material containment functions, the containment isolation system, combustible gas control, leakage testing, and fracture prevention for the pressure vessel.

Next slide, please.

The US-APWR containment completely encloses the reactor and the reactor coolant system.

The containment is essentially a leak-tight structure to ensure that no significant amount of radioactive material can reach the environment, even in the event of an RCS failure. The ESF systems that are directly associated with the containment include the structure, which is the vessel and the various subcompartments, the spray system, the isolation system, and the hydrogen monitoring and control system.

The containment is designed as an essentially leak-tight barrier that will safely and reliably accommodate the calculated temperature and pressure conditions resulting from a complete spectrum of break sizes up and including a double-ended guillotine break of the reactor coolant or main steamline. It is designed to be compatible with all of the environmental conditions that are experienced during normal operations as well as to withstand a broad spectrum of seismic events.

The US-APWR containment is a pre-stressed, post-tensioned, concrete structure with a cylindrical wall, a hemispherical dome, and a flat reinforced concrete foundation slab that is designed to withstand the negative pressure of 3.9 psig. The design life of the US-APWR containment is 60 years. A diagram of the containment is provided on the next slide.

The containment has three large openings which include two personal airlocks and an equipment hatch. The penetrations from mechanical or electrical equipment go through the containment annulus which has its own emergency exhaust system for ensuring that the exhaust from the annulus is filtered before discharge. Note that the main steam line and the feedwater piping lines are not located in these penetration areas and are thus not served by the annulus emergency exhaust system.

And finally, the last bullet here covers one of the unique features of the US-APWR containment which is the fact that the refueling water storage pit which is the source of borated water for emergency core cooling and the containment spray system is located at the bottom of containment.

Next slide, please.

MEMBER BANERJEE: Is that the pit, the depression at the bottom? The next slide. Is that the pit?

MS. STEINMAN: I have pictures of the pit later on in different slides. This is actually just showing the structural parts of the containment.

MEMBER BANERJEE: Right, the depression is to accommodate the pit? Or is that something completely

different?

MS. STEINMAN: I believe this here -- no, it is something completely different.

MEMBER BANERJEE: It's something completely different.

MS. STEINMAN: That is correct. There are pictures that will show that in various other diagrams later in the presentation.

MEMBER BANERJEE: Okay.

MS. STEINMAN: This slide actually does show a diagram of the containment vessel which has an inner height of approximately 225 feet and an inside cylinder diameter of approximately 150 feet. The containment dome and the wall thicknesses are roughly four feet thick, exact dimensions are provided on the slides. The overall size of the containment is essentially in line with conventional PWRs if you scale up according to the power for the US-APWR.

This slide provides a basic summary of the basic design specifications for the containment vessel. As I stated previously, the US-APWR containment vessel is a pre-stressed, concrete containment vessel with a carbon steel liner. The design pressure of that vessel is 68 psig or 83 psia. The design external pressure is 3.9 psig and the design temperature of the structure

is 300 degrees Fahrenheit.

MHI has evaluated the performance of the containment system under postulated accident conditions using GOTHIC and other computer codes. The supporting design basis calculations are described in Section 6.2.1.1 through 6.2.1.5 of the DCD. The results of these calculations are incorporated into other aspects of the design including such things as the EQ program, the piping design, the sump strainer design, and the ultimate heat seat design in terms of the energy load. A basic overview of the main assumptions and the results of each evaluation will be described on the subsequent slides for this section.

First up, is the maximum containment temperature and pressure analysis which evaluates the capability of the ESFs under primary and secondary system breaks. The general purpose thermohydraulics code GOTHIC is utilized for these analyses using a single volume containment node that is verified by the experimental analyses which are listed in parentheses on this bullet.

The results of these analyses are evaluated against the SRP acceptance criteria that the design pressure has at least 10 percent margin to the peak calculated accident pressure and that the peak pressure

reduces to have of its peak value by 24 hours post-accident.

The results of the MHI analyses lead to the following conclusions. The peak calculated value for pressure is 59.5 psig which compares to the design value of 68 psig. And the peak calculated value of temperature is 284 degrees F. which corresponds to the design temperature of 300 degrees F.

CHAIRMAN STETKAR: Rebecca, that peak calculated temperature, you carefully said that's under a LOCA. The -- what I've seen is the peak containment atmosphere temperature during the design basis main steam line break is 355 degrees Fahrenheit. Apparently, in the response to an RAI, you did some analyses to show that the temperature of the containment structural elements during that steam line break because of the duration of the transient remained below the 300 degree Fahrenheit structural qualification temperature.

I had a question about all of the instrumentation cables, all of the equipment that's located inside the containment that would indeed be exposed to the temperature of 355 degrees for some period of time, short period of time for the peak temperature, but temperatures in excess of 300 degrees for a longer

period of time.

What temperatures are all of that equipment and cables and instrumentation and cabinets and all of that stuff qualify to? Can it survive that main steam line break?

MR. SETO: I am Naohiko Seto. The temperature mitigation method applied to the containment vessel itself. We assume it's applicable to the structures with large heat capacities. A more severe condition, more severe condition applied to them. So it is environmental conditions over 300 degree Fahrenheit.

MEMBER BLEY: Could you say that last part again?

MR. SETO: Environmental conditions for the components are vulnerable would be higher ones than 300 degree Fahrenheit.

MEMBER BLEY: If I understood you right, you're saying all of the components, electronics, whatever is in there is qualified to over 350 degrees Fahrenheit? Is that what you said? I'm not sure.

MR. SETO: Containment vessel or concrete with large heat capacity. For example, almost all of them are environmental conditions are over 300 degrees Fahrenheit. So this is a case-by-case --

MR. SPRENGEL: I think this question is related to Section 311.

CHAIRMAN STETKAR: That could -- I understand how this works. I was going to ask you where those environmental qualifications are documented. So you're going to punt the 311?

MS. STEINMAN: The EQ program would be responsible for providing the qualification of the types of equipment that you mentioned, the electrical cables, instrumentation, and other components, and that program is described in DCD Section 3.11 and there's also an appendix, Ii believe it's 3D, but I'd have to double check that to be positively sure, that provides specific values for different components and what the temperature pressure and environmental conditions, those items are exposed to and what they're required to be qualified for.

CHAIRMAN STETKAR: Thanks. We haven't reviewed DCD Chapter 3 yet. So I will just mark that question and bring it up when we get to DCD Chapter 3.

MR. SPRENGEL: And that will be November 4th and 5th.

CHAIRMAN STETKAR: Okay.

MEMBER BROWN: Does that include things like sensors? I heard the words cables and stuff, but

I didn't hear the word electronic sensors.

CHAIRMAN STETKAR: They said instruments.

MEMBER BROWN: I missed that. That's fine.

MEMBER BANERJEE: So I'm just trying to get an overall feel for this. The containment is structurally designed for 300 degrees Fahrenheit, is that what I understand.

MS. STEINMAN: Three hundred degrees Fahrenheit, that is correct.

MEMBER BANERJEE: But there are incidents or accidents, whatever, which could lead to higher temperatures?

MS. STEINMAN: That is correct.

MEMBER BANERJEE: That's correct. And what is the sort of consequences of that? I didn't get a clear feel for the answer to John's question.

MS. STEINMAN: The answer was that because of the short duration of the higher temperature profile, the key capacity of the structural materials are not expected to raise significantly and so the structural aspects of the containment are not expected to experience that higher temperature and they're expected to remain below the 300 degrees Fahrenheit design temperature.

MEMBER BANERJEE: So what you've done is you've done a calculation to show that only the surface of the structure is heated up. The rest of it is not? Is that what it means?

MS. STEINMAN: Yes.

MEMBER BANERJEE: You've done a transient calculation for this?

MS. STEINMAN: We have performed a transient calculation for this? Yes, we have.

MEMBER BANERJEE: For the structures.

MEMBER REMPE: And the transient was selected from design basis events, right?

MS. STEINMAN: That is correct.

MEMBER BANERJEE: So what was the highest temperature they were exposed to?

MR. SETO: The highest temperature, well, we have additional -- in addition, we conducted calculations inside the containment with multinodal system. I am not sure, however, shorter duration is a local compartment temperature exceeds 500 degree Fahrenheit under the assumption over main coolant pipe, double ended break in the reactor cavity.

MEMBER BANERJEE: So then you take the duration of this and you did a solid structure heat transfer calculation, applying the boundary condition

on the surface of the structure, if I understand that's what you did?

MR. SETO: Yes.

MEMBER BANERJEE: With the multi-nodalization of the structure? I am not following exactly what you did. How did you determine this?
high void fraction? Did you do a conduction calculation for everything?

MR. SETO: Yes, initially, we conducted multi-node pressure and temperature calculation and after that --

MEMBER BANERJEE: Inside the containment?

MR. SETO: Yes.

MEMBER BANERJEE: For the fluid systems? For the multi compartments?

MR. SETO: Yes.

MEMBER BANERJEE: But your calculations for the overall pressure used only one node, but then you did additional calculations for the compartments?

MR. SETO: Yes.

MEMBER BANERJEE: What did you use? Did you use GOTHIC for the one node calculation, right? So what did you use for the multi-compartment calculations?

MR. GEORGE: We used GOTHIC for the multi-node as well.

MEMBER BANERJEE: You used GOTHIC as well? Okay.

By the way, there's a little misprint in the SER where the unequal temperature capability of GOTHIC is attributed to different velocities. It's not that. So just you have to correct your SER on that point. I'll point it out to you.

Okay, the non-equilibrium capability comes from the ability to handle different temperatures, not different velocities. Anyway, going back to your point about -- so you used GOTHIC for the compartments, right?

MR. SETO: Yes.

MEMBER BANERJEE: And now you've got the temperatures in each compartment?

MR. SETO: Yes.

MEMBER BANERJEE: And you got the duration. How did you then do the solid structure calculations?

MR. SETO: Solid structure calculations are conducted to separate from the containment pressure and temperature calculations, results from the pressure temperature calculation incorporated as a boundary condition.

MEMBER BANERJEE: So you applied the

boundary condition. Was that a 1D or a 3D calculation? Because I see allusions to 1D calculations. Did you do a full 3D calculation of the solid structures?

MR. SETO: No, just 1D.

MEMBER BANERJEE: 1D, okay. So how did you determine that the structure was not exposed to more than 300 degrees or whatever the design temperature was? From this 1D calculation?

MS. STEINMAN: So you would like to have a complete understanding of the methodology that we used to determine that the containment structures do not heat up to the higher temperatures associated with the main steam line break?

MEMBER BANERJEE: Or whatever -- I mean there are many accidents here.

MS. STEINMAN: That is correct.

MEMBER BANERJEE: Which will give you local temperatures above 300 degrees Fahrenheit. So I would like to understand how you did the calculation to determine really that you would not get an unacceptable temperature in any region of the containment. So I mean I don't really understand what you mean by designed to 300 degrees Fahrenheit because there will clearly be regions of the containment which will be exposed to higher temperatures. Do you mean bulk? Do you mean

on the surface? Do you mean -- you know, what does that statement mean? And how do you show conformance to that?

MS. STEINMAN: I believe we'll take that back as an action item to address?

MEMBER BANERJEE: I think it's just a point for clarification. I'm sure you've done the calculations. I just want to know.

MS. STEINMAN: Right. I think we just don't have the relative expert to provide the details of that calculation.

MEMBER BANERJEE: That would be cleared under Chapter 3? Or will you --

CHAIRMAN STETKAR: That's not an EQ. That's a structural --

MEMBER BANERJEE: Yes. But I mean --

CHAIRMAN STETKAR: That's a different issue.

MEMBER BANERJEE: It depends on where you want to discuss it, but we should certainly discuss it to satisfy ourselves.

Again, to repeat the question just for clarification, when you say it's designed for 300 degrees Fahrenheit, what does that mean exactly? Does it mean that regions can be briefly exposed to higher

temperatures and if so, for how long? You know, that's the question.

And then how did you calculate the temperatures and what did you find? So if you did 1D calculations, is it then true that the 1D is sufficiently accurate even in the compartments and regions like that? Or did you actually do some 3D calculations with the appropriate boundary conditions? I'm prepared to accept that within a compartment you've got well-mixed conditions or relatively well-mixed conditions. So you can probably apply the temperature field and the pressure field rather than boundary condition, but then how do you do that calculation after that?

MR. SPRENGEL: So we'll be taking two actions out of this one for Section 311 on NEQ and the other one will be tied to Section 3.8 and the structural evaluation.

MEMBER BANERJEE: By the way, are you going to discuss these GOTHIC calculations and things when you come up with these 59.5 psig? For example, were you planning to give us a little bit more detail on how this was done or is the staff going to tell us how they agreed with you on this? I don't know.

MS. STEINMAN: I believe the staff includes some of their confirmatory calculations to describe how

they agree with our calculations. If you have specific questions associated with any of the information in the DCD, we would be prepared to talk about that, but our presentation currently does not include those details.

MEMBER BANERJEE: So for example, if I understand it, you used a one node calculation in GOTHIC, right?

MS. STEINMAN: That is correct.

MEMBER BANERJEE: But what did you do with the compartment analysis? You then divided -- did you do a more detailed nodalization? That's not completely clear. That's why I'm asking the question. What was your methodology? How did you go through this? And how did you validate that you were correct?
Why isn't it 62.5?

MR. SETO: We will be able to report later. Because right now the calculations are underway.

MS. STEINMAN: So as will be shown on the next slide, the subcompartment methodology is described in MUAP-07031 and that report describes the specific methodology associated with the subcompartments and which specific subcompartments were evaluated.

MEMBER BANERJEE: Can you just tell us in words what it was? How you did it in five words or a paragraph so we don't need to go and look in detail?

You can always give us reference to 50 reports. There's no way I can read 100 or 200 reports. Can you just tell me in brief what you did?

MR. SETO: We have not submitted the report regarding this methodology yet.

MEMBER BANERJEE: Okay. That's fine, but can you just qualitatively describe what you did? You took each subcompartment as a volume or did you subdivide them further or what did you do?

MR. SETO: Only containment dome is subdivided. Other compartments below operation floor are modeled for each compartment.

MEMBER BANERJEE: That clarifies what you did. So basically you divided the dome. You nodalized that. And then every other compartment or subcompartment you took as one volume?

MR. SETO: Yes, one volume.

MEMBER BANERJEE: With some connection?

MR. SETO: Okay.

MEMBER BANERJEE: And that report is still to be submitted, the detailed calculation methodology?

MR. SETO: Not submitted.

MEMBER BANERJEE: Not submitted, okay. So when do we get a chance to review this methodology and these are interesting and important calculations you're

doing, so when do we get into the details of this?

MR. SETO: Well, we have been -- we have thought this item as a matter --

CHAIRMAN STETKAR: Sir, could you speak up a little bit? Either pull the microphone towards you a little bit because our recorder is having a difficult time picking you up. Thank you.

MR. SETO: Because we have our thought that this matter is regarding Chapter 3 so on this time, now so we have not prepared the report of calculation methodology.

MEMBER BANERJEE: So when it comes to Chapter 3, you will describe in more detail what you did here? These are just the results that you're showing here? I just don't understand when we are going to --

CHAIRMAN STETKAR: I think what we're asking and you made reference to MUAP-07031. I'm just looking through my notes feverishly here. I don't think I've ever read that report.

MEMBER BANERJEE: It hasn't been submitted.

CHAIRMAN STETKAR: I have a copy of it. It's an 2009 version. But is that report prepared to support the containment structural analyses for Chapter

3 of the DCD? It is a subcompartment analysis report. That's essentially what's in it. When do we have the opportunity to kind of ask these probing questions about those analyses, if not today, then is it part of the Chapter 3 review. If not part of the Chapter 3 review, then when is it?

MEMBER SCHULTZ: And is that the report that you refer to in the second bullet where you describe the GOTHIC code and it's verification against the experimental analyses?

MS. STEINMAN: So the subcompartment analysis that I described in MUAP-7031 is not the report that supports this particular analysis. It reports the subcompartment analysis which is described on the next slide. That analysis doesn't determine the temperature effects which are part of this analysis. The methodology for this analysis for the maximum containment pressure and temperature analysis, where is that described?

MR. SETO: The methodology for the maximum containment pressure and temperature analysis are described in DCD itself, but it is for single nodal calculations.

MEMBER BANERJEE: That is the single node calculation which I think the staff also did

confirmatory calculations, right? But the subcompartment analysis has still to be submitted from what I understand?

MR. SETO: EQ calculation and subcompartment analysis are different because subcompartment analysis methodology is in compliance with regulation so calculation is performed under assumption or some EQ temperature. Very different features.

MR. SPRENGEL: Please clarify which report contains the methodology to be submitted?

MR. SETO: Well, for EQ calculation there is no idea at the present.

MR. SPRENGEL: Please give us a moment, we'll follow up on this.

CHAIRMAN STETKAR: We have a two-day meeting scheduled here, so some time during the --

MEMBER BANERJEE: So I'm trying to interpret actually what you said. For the subcompartment analysis, you assume equal temperatures with steam and water. For the EQ calculations, you use the non-equilibrium option and GOTHIC which allows you to have different temperatures.

MR. SETO: Yes.

MEMBER BANERJEE: To determine the maximum

temperatures, right? Because the steam temperature will be different from the water temperature.

MR. SETO: Yes.

MEMBER BANERJEE: Okay, and you do the first because that is sufficient to meet the regulatory requirements, that's the equilibrium assumption. So is my understanding correct or have I got it wrong that you do two separate calculations?

MR. GEORGE: I'm Tom George, consultant to MHI. There are basic three GOTHIC models. One is the single-volume model for peak containment pressure and temperature conditions which is the subject here today. And there's also a number of subcompartment models which are for individual compartments within the containment and those have various number of nodes and those are not considered the structural temperatures. Those are only for pressure calculations, short-term pressurization of those compartments. And then there's a third model for the EQ analysis which is outside of the scope of this meeting at this time.

MEMBER BANERJEE: Which uses --

MR. GEORGE: Multi-volume model.

MEMBER BANERJEE: Multi-volume. So just to understand the overall situation, the subcompartment model calculations are done assuming thermal

equilibrium. The EQ calculations are done allowing the phases to be whatever temperature they want to be, based on some non-equilibrium calculations. And again, using GOTHIC?

MR. GEORGE: Yes.

MEMBER BANERJEE: And from what you told us earlier, the subcompartments are used primarily, except for the dome region as one single node. They're not subdivided further within the subcompartment or did I get that wrong?

MR. GEORGE: For the EQ analysis, that's correct.

MEMBER BANERJEE: Could we have a picture of what all these analyses are and what each analysis did? I mean you can refer to 50 reports again, but I have no way to read these. I don't have the time. So could we have sort of a table saying these are the analyses done. This was the sort of nodalization we used in various places. This was thermal equilibrium assumption. This was non-equilibrium. And these were the results. It would be very helpful to have it all in one place and how would they validate it, you know?

MS. STEINMAN: Yes, we can provide that.

MEMBER BANERJEE: And what we are having here also is for the solid structures. It's not clear

sometimes you're doing a 1D calculation, are you doing sometimes 2D calculations in complicated structures, how do you apply 1D? I don't know. Maybe your 300 degrees doesn't work for anything except the outer shell. Where does that apply, the 300 degrees limit? Is it to just the shell of the containment? What about the internal structures? Is there a limit associated with that? It's all very fuzzy in my mind. Maybe it's -- I'm sort of a thermal hydraulics guy. I like to have precision and detail of what's going on. So, some clarification.

MEMBER SCHULTZ: The other piece that would be helpful is where for each of these three analyses where the results and the methodology is documented, because it sounds as if the EQ is somewhere, but not identified.

MS. STEINMAN: Right, there is summary level information for each one of the analyses in the DCD and then, of course, there are technical reports that support some of the analyses in more detail.

MEMBER SCHULTZ: But including that on the map that Sanjoy is describing would be very helpful.

MS. STEINMAN: Thank you.

MEMBER BANERJEE: And the DCD is evolving under us. The flow paths are changing and all sorts

of things are happening. So are you redoing all this analysis? What's happening?

MS. STEINMAN: There have been RAIs related to that that we'll discuss a little bit later.

MEMBER BANERJEE: Okay. And you know, of course, now you're going to hydrogen where I have 100 questions.

MS. STEINMAN: Well, in this case, we just have summary conclusions on this slide, that the results of the analyses for the maximum containment pressure and temperature analyses demonstrate that the containment withstands the external pressures up to 3.9 psig which we have a typo on this slide. It does say psia, but it should be psig. And that the pressurization due to hydrogen burn is demonstrated to be within the structural capability of the vessel. And in the cases of these particular calculations they are performed with severe assumptions as inputs to these such as a loss of off-site power and a single failure in addition to online maintenance. So you have trains that are out of service in conjunction with the spectrum of breaks that are analyzed up to the double-ended pipe break. And we understand that you're looking for more detail about the specific methodology associated with --

MEMBER BANERJEE: So with the hydrogen, clearly burned, there are questions about how you handle the igniters and deflagration to detonation, transitions because there's a lot of detail there somewhere which I haven't had the time to go through. But once you start to open this can of worms, I'm sure there's going to be a lot of questions.

Are you going to treat that later or have you already discussed this?

MS. STEINMAN: There's some basic information in this presentation regarding the igniters, but the specific calculations are not described in this presentation.

MEMBER BANERJEE: So where are those specific calculations done and when will it be discussed?

MS. STEINMAN: They're done under Chapter 19.

MEMBER BANERJEE: Have we done that already?

CHAIRMAN STETKAR: We have done that already.

MEMBER BANERJEE: Somebody went through all these calculations, deflagrations and stuff.

CHAIRMAN STETKAR: The simple summary is

you don't get to a detonation because they just assume --

MEMBER BANERJEE: It burns.

CHAIRMAN STETKAR: A burn.

MEMBER BANERJEE: I'm sure the staff has asked these questions.

CHAIRMAN STETKAR: The staff did have -- we did discuss some of this in Chapter 19 and the staff did indeed have several questions about locations of the igniters, reliability of the igniters, MHI made some design changes and the staff did ask several questions about compartmentalization effects. So at not your level of detailed analysis probably because those of us who are sitting in the room don't have your special expertise, but we did discuss a lot of those issues at that level and the staff did do a fairly, I think, a fairly extensive review.

MEMBER BANERJEE: Do you recall what was the calculation code they used?

CHAIRMAN STETKAR: No.

(Laughter.)

I, too, can rattle off codes that you've never heard anything about and wouldn't remember.

(Laughter.)

MEMBER BANERJEE: Maybe this is a

specialized code of some sort.

CHAIRMAN STETKAR: We can look it up.

MEMBER REMPE: Wasn't ERI involved in the review?

CHAIRMAN STETKAR: I think ERI was because you had some questions for ERI.

MEMBER REMPE: Right. I think they had their own -- again --

CHAIRMAN STETKAR: I don't recall. But there was, I know the staff asked several RAIs and I know the RAIs --

MEMBER BANERJEE: They're very critical in this.

CHAIRMAN STETKAR: Right. Okay.

MEMBER BANERJEE: So that's been covered and everybody is satisfied that these igniters that have been modified.

CHAIRMAN STETKAR: It's been covered. We get another shot at it in the next phase, in the final phase.

MR. SPRENGEL: I think the categorization was correct though. There was many questions by the staff and there were adjustments made.

CHAIRMAN STETKAR: There were.

MR. SPRENGEL: And additional analyses

run.

CHAIRMAN STETKAR: There were power supplies. At one time there might have been an igniter in the RWSP space and that doesn't exist any more.

MR. SPRENGEL: So there were some concerns identified.

CHAIRMAN STETKAR: And compressurizer compartment and things like that.

MR. SPRENGEL: MAP and GOTHIC are the codes used.

MEMBER BANERJEE: And the mixing calculations were done how? With GOTHIC?

MR. SPRENGEL: GOTHIC, right.

MEMBER BANERJEE: Okay. Did you do any CFD calculations of any sort?

MR. SETO: No. No CFD calculations besides GOTHIC.

MEMBER BANERJEE: Okay. Let's move on since this has been covered.

MS. STEINMAN: Next one of our containment functional design areas that we would like to cover in terms of the calculations that were performed, this is compartment analysis. Technical report, MUAP-07031, as I previously mentioned is the technical report that describes the subcompartment analysis and it provides

information regarding the pressures in the reactor cavity, the steam generator compartment, the pressurizer compartment, regenerative heat exchange room, regenerative heat exchange valve room, and the letdown heat exchanger room.

M-RELAP5 was used to calculate the mass and energy release rate and GOTHIC was used to calculate the pressures in the individual's compartment. The analysis conditions for the pressure calculations comply with the requirements in SRP 6.2.1.2.

CHAIRMAN STETKAR: I think this is the appropriate time to ask this question and tell me that it's not if it's not. When I went through the subcompartments, you list on this slide however many, one, two, three, four, five, six specific subcompartments. In the DCD, the pressurizer spray valve room is explicitly excluded from the subcompartment analyses. And Section 6.2.1.2.2 says that there is no postulated pipe break location in the pressurizer spray valve room because the terminal ends of pressurizer spray line are not located in the pressurizer spray valve room and pressurizer spray line -- in the pressurizer spray valve room is designed that the maximum stress range and cumulative usage factor as calculated by the ASME code and so forth.

I don't understand the rationale for excluding the pressurizer spray valve room. The pressurizer spray pipe -- I mean the valve, as indicated by the name, the valve room I'm pretty well assuming includes the pressurizer spray valves. Just a guess.

Pressurizer spray valves are normally pressurized to reactor coolant system pressure. They're at the discharge line of the reactor coolant pumps. So they're operating at reactor coolant system pressure. The same as all the other reactor coolant system piping that's designed to all the same codes that you reference in that statement that I read. So if I can get a reactor coolant system piping break in another subcompartment that could pressurize that subcompartment, why can't I get a beak in the pressurizer spray piping or blow out a pressurizer spray valve and pressurize the pressurizer spray valve compartment?

MR. SETO: Well, at present MHI's piping safeguard policy can exclude the break assumption for this piping. However, it is now reexamined. So maybe -- well, sorry. I --

(Pause while conferring.)

MR. SPRENGEL: John, for clarification, on the introduce of your question, are you referring to the section about the pressurizer spray valve room and

that there are no postulated type break locations in that room?

CHAIRMAN STETKAR: The statement in the DCD basically says that. It says there are no postulated pipe break locations in the pressurizer spray valve room. Because the terminal ends of the pressurizer spray line are not located in the pressurizer spray valve room, and the pressurizer spray line in the pressurizer spray valve room is designed that the maximum stress range and the cumulative usage factor as calculated by the ASME code, Section 3 does not exceed the allowable in accordance with the criteria described in subsection DCD 3.6.2.1.1.2 is the entire sentence.

Now what that basically says is there are no terminations of the piping in that room and the piping in the room is designed according to ASME code. I submit that all of the piping that's connected to reactor coolant system is designed to the ASME code, so if you postulate breaks in that piping and other compartments, I don't see that as a rationale for not postulating a break here and I'm not sure what you mean by the terminal ends of the pressurizer spray valve spray line are not located in the room because I'm just presuming because of the room name that it's got these pressurizer spray valves in there. Now those are not the termination of

the spray line at the pressurizer or at the reactor coolant loop, but indeed there are welds or some sort of connections to the spray valves and the spray valves themselves, I would assume are in that room. So it's not just a smooth straight run of pipe that goes through the room. It has some sort of connections in there. So I didn't understand that whole rationale. It's certainly a pressurized line by definitions. It's designed to ASME code because of its connection to the reactor coolant system. I can't understand the rationale for excluding breaks in that location. That's the only rationale that's given. And quite honestly, the SER regarding this just says the applicant did not perform a subcompartment analysis for the pressurizer spray valve room because there is no piping postulated breaks inside this room.

Okay? Well, they didn't ask you. I'm asking you to justify why there aren't breaks possible in this room?

MEMBER BANERJEE: Is there some LBB criteria --

CHAIRMAN STETKAR: No.

MEMBER BLEY: No.

CHAIRMAN STETKAR: Not for this line. Pressurizer surge line only.

MR. SPRENGEL: This is just pointing back to the ASME code as you identified.

CHAIRMAN STETKAR: Yes, but I mean the ASME code applies to any other piping section anywhere --

MS. STEINMAN: So you are looking for the explicit reason why this particular chunk of piping is excluded.

CHAIRMAN STETKAR: Exactly, for example, the pressurizer compartment, all of that piping and everything else in that compartment is designed to the ASME code as is the steam generator -- just citing the ASME code as a design basis doesn't by itself exclude this room because you could cite the same types of code requirements for any of the other six locations there.

MS. STEINMAN: I believe this exclusion might be in GCD Chapter 3, but I'm not familiar with it off the top of my head --

CHAIRMAN STETKAR: Now wait a minute, GCD Chapter 3, explicitly excludes the pressurizer spray valve room --

MS. STEINMAN: No --

(Laughter.)

MS. STEINMAN: I think the general exclusions associated with different piping are described there.

MR. SPRENGEL: She's correct. Section 3.6 actually goes through what are selected for postulated pipe breaks. It goes through in detail terminal ends may be excluded. I think there is an open question that we need to follow up on with this item and it does kind of come back to your point about the valves.

CHAIRMAN STETKAR: That's right. I mean I'm not sure what a terminal end means. I understand this connection to the pressurizer and the reactor coolant loop, but it would seem that there are -- I'm assuming they're welded in place and not flanged, would seem that they're welded connections in this room, other than the normal straight pipe --

MR. SPRENGEL: The terminal, they give examples and a more explicit definition of what that means.

CHAIRMAN STETKAR: Anyway, let me just raise the question and see if you can follow up.

MR. SPRENGEL: Your question is actually relying on the 3.6 evaluation. So give us a little time and we'll see what we can answer here, if not, in the meeting next month for Chapter 3.

CHAIRMAN STETKAR: Thanks, Ryan.

MS. STEINMAN: Would you like to move on --

CHAIRMAN STETKAR: Is it GCD Section 3.6?

MR. SPRENGEL: It's actually points to Section 3.6.2.1.1.2.

CHAIRMAN STETKAR: DCD, not GCD.

MR. SPRENGEL: Yes.

CHAIRMAN STETKAR: But that's just the design criteria as I understood it.

MR. SPRENGEL: It's actually a section on postulation of pipe breaks.

CHAIRMAN STETKAR: Okay. Anyway, get back to us and see if that -- I did not look at what section.

MS. STEINMAN: So MHI has evaluated the mass and energy for containment pressure for both LOCAs and secondary pipe breaks. And this slide provides a very high-level overview of those analyses.

The LOCA mass and energy analysis is described in the approved topical report, MUAP-07012. This analysis uses the SATAN and WREFLOOD codes modified with US-APWR specific features and the GOTHIC code in conjunction to cover the mass and energy release aspects of the evaluation for blowdown, refill, core re-flood, and long-term core cooling. The limiting conditions for the pressure calculation are the cold-leg double-ended break with a Cd equal to 1 and two SI pumps operating under LOOP conditions.

For the secondary piping system mass and energy releases, MHI has used the MARVEL-M code for the mass and energy release calculation for the main steam line break with a spectrum of break area and power generation levels. The MARVEL-M code is described in the topical report, MUAP-07010.

MEMBER BANERJEE: This is for the overall containment calculation, right? This is not for the subcompartment?

MS. STEINMAN: That is correct. And in the case of the secondary piping system, the limiting conditions for containment pressure are a double-ended break with Cd equal to 1 at 102 percent power. And would be a main steam line break.

Next slide, please.

And the final analysis that we're going to discuss this morning is the minimum containment pressure for ECCS capability study. These analyses were performed to confirm the conservatism and validity of the ECCS performance evaluation in Chapter 15. The boundary conditions for the large break LOCA PCT are determined using WCOBRA/TRAC as described in MUAP-0711. The mass and energy release used for the analysis is consistent with the nominal large break LOCA case and other assumptions are selected to conservatively choose

initial conditions that result in maximizing the depressurization.

The minimum containment pressure is calculated using GOTHIC in accordance with the guidance of SRP 6.2.1.5 and BTP 6-2.

MEMBER BANERJEE: What were the -- were there different assumptions made for the subcompartment analysis that you did in terms of pressurization and temperatures? Did you assume leak before break and things like that? Will you be describing that later on for the subcompartment?

MR. SETO: Excuse me, do you mean --

MEMBER BANERJEE: The analysis --

MR. SETO: Before break?

MEMBER BANERJEE: Yes. Where did you apply those criteria?

MR. SETO: LBB is applied to the subcompartment analysis only. So maximum containment pressure and temperature variation calculation. LBB is not applied.

MEMBER BANERJEE: I know for the maximum, it is not. But for the subcompartment analysis, what were the set of assumptions you made or will you describe these later? I don't know.

I see. You're saying two specific areas

remain open. Okay, containment --

MS. STEINMAN: That is correct.

MEMBER BANERJEE: Okay.

CHAIRMAN STETKAR: Just for clarification, I was trying to look up things, but perhaps I can get the answer more quickly. You only applied leak before break considerations for the pressurizer surge line, is that correct? Or did you apply those for other locations?

MR. SETO: No, it is applied --

MR. KATSURA: My name is Yoksue Katsura. LBB is applied to the coolant loop piping main steam line piping. For these pipings, LBB is applied.

MEMBER BANERJEE: So the failures that were considered for your subcompartment analysis were what exactly? What failures do you apply?

MR. GEORGE: Go back to the previous slide. Two slides. What line were you assumed to break and say --

MR. SETO: All the way up the cavity. We assume direct injection line break, double ended.

MEMBER BANERJEE: What was the diameter? Eight inches?

MR. SETO: Four. And for steam generator compartment we assume main feeder with the line break

and pressurizer compartment, surge line -- no surge line -- applied to surge line breaks.

MEMBER BANERJEE: Spray line?

MR. SETO: Yes, spray.

MEMBER BANERJEE: So the spray line was allowed to break?

MR. SETO: For pressurizer compartment.

MEMBER BANERJEE: Okay. So they were all below eight inches?

MR. SETO: Yes, below eight inches.

MEMBER BANERJEE: Above eight inches you apply -- you assume they don't break? I'm just trying to understand the logic of what you did? Is it in SRP 6.2.1.2 or whatever?

MS. STEINMAN: I believe these criteria are covered in Chapter 3 as well.

MR. KATSURA: This is the 3.6.3.

CHAIRMAN STETKAR: 3.6.3 discusses the leak before break criteria for high-energy line pipe breaks. But as I read Section 6.2.1.2, it was my understanding that only breaks of the pressurizer surge line in the pressurizer compartment were excluded from the subcompartment analyses due to leak before break considerations. Now maybe I misinterpreted that and I'm not sure I can say it twice, but as far as the

subcompartment analyses in Chapter 6 of the DCD, the only discussion that I saw about leak before break was related to the surge line and in particular because it's in the pressurizer subcompartment, elimination of that. So they did look at breaks of smaller lines as they mentioned, in the pressurizer compartment, but not the surge line.

I didn't see any other exclusion, at least documented in 6.2.1.2.

MEMBER BANERJEE: All I'm looking for is what was excluded.

CHAIRMAN STETKAR: Right, and unless I misinterpreted something the only -- from a leak before break consideration, they exclude for high-energy pipe breaks and pipe whips and all of those sorts of things, they use the LBB for a larger number of lines and that's apparently documented in Section 3.6 --

MR. HAMAMOTO: This is Hiroshi Hamamoto for Section 3?

CHAIRMAN STETKAR: Yes.

MR. HAMAMOTO: Leak before break is over to six-inch line is considered the break.

CHAIRMAN STETKAR: But are those considerations applied only to limit the analyses for pipe whips and blowdown effects and that type of issue,

the more mechanical versus the subcompartment pressurization and temperature effects that we're talking about here. And in Chapter 6 of the DCD, I only saw LBB --

MEMBER BANERJEE: Perhaps that's the only one excluded, I don't know --

CHAIRMAN STETKAR: But now I'm a bit confused about what was excluded or why from the subcompartment analyses.

MR. HAIDER: My name is Syed Haider. I'm the reviewer for Chapter 6.2.1 and 6.2.2. Yes, I would like to confirm that the pressurizer surge piping room was not analyzed based on the leak before break, LBB approach, and that was the only item that was excluded from the analysis in our review.

CHAIRMAN STETKAR: Now Chapter 3.6, we may hear other stories about LBB as far as pipe width and things like that, but those are not part of the subcompartment analysis for this purpose.

MEMBER BANERJEE: So I think you should confirm that that was only excluded line.

CHAIRMAN STETKAR: For the subcompartment analyses.

MEMBER BANERJEE: The specific question is what was excluded. So the only thing excluded was the

pressurizer surge line. But just confirm that, please. Okay, we can go back.

MS. STEINMAN: There is one open item associated with Section 6.2.1 and as somebody already pointed out, it is in relation to the subcompartment analyses and the secondary pipe mass and energy release. RAI 923, Question 6.2.1-21 is the RAI there and it was related to impacts of the design change that you mentioned earlier and how they impacted the various calculations that were covered in this section of the DCD.

MHI has submitted a response to this and revised the DCD in some cases to provide additional clarification of how that design impacts the various calculations, but this RAI is still under review by the staff and there is on-going discussion for the two areas on this slide.

The staff's presentation covers this particular open item in detail and so in order to save time, if it's possible, any additional questions on this area should probably be held until the staff's presentation because they have, I believe, two or three slides on this topic.

CHAIRMAN STETKAR: Any other questions on those topics?

Brian, you're about to say something?

MR. SPRENGEL: I think while we're all still engaged right here, there is a table in the DCD, Table 6.2.1-17 that provides the results of LBB evaluations and specifically identifies which ones are --

CHAIRMAN STETKAR: Yes.

MR. SPRENGEL: -- identified as leaking and breaking.

CHAIRMAN STETKAR: Yes.

MEMBER BANERJEE: You gave us a quick answer. Is it correct? It's only the pressurizer surge lines?

MR. SPRENGEL: There are one, two, three, four, five, six, seven. There are seven items identified.

MEMBER BANERJEE: What were the others, anything significant?

MR. SPRENGEL: Main coolant, pipe hotleg, coldleg, crossover leg, pressurizer surge line, accumulator, injection line.

CHAIRMAN STETKAR: But those lines are with the exception of the surge line, those lines are out in what I'd call the bulk containment atmosphere, if you will. They would contribute to -- they wouldn't

necessarily contribute to the subcompartment issues that we're addressing here with the exception of the surge line because it is in the pressurizer compartment.

MR. SPRENGEL: That sounds correct.

CHAIRMAN STETKAR: I think back to the subcompartment analyses, I think that it's true that the only line break for the subcompartment analyses that was excluded for leak before break was the surge line.

MEMBER BANERJEE: Thanks.

MR. SPRENGEL: That was confirmed. And to go back to the question about the pressurizer spray valve, it ultimately comes down to the ASME classification of 6.1.31 and the other system piping has -- this was your question before about the exclusion. The pressurizer spray valve line is in Table 3.2-2. Sorry, 3.2-2, classification of mechanical systems. That line is identified as it's ASME Class 1 and so when you go to the section I identified in Chapter 3 --

CHAIRMAN STETKAR: Ryan, I want to keep us a little bit on schedule. We've already established the fact that breaks of the pressurizer spray valve line are analyzed in the pressurizer spray -- in the pressurizer compartment. They are analyzed in the pressurizer compartment. So regardless of what you say

about ASME classification, the same piping is in both compartments. That spray line, we already heard it this morning. I just wanted to cut off this --

MR. SPRENGEL: That was just for clarification.

CHAIRMAN STETKAR: Yes. Any other questions about these issues? I was going to -- well, we still can break early, but it's not as early as I thought. What I'd like to do before we get into the containment heat removal systems because there will be more discussion is take a break and we'll recess until 10:20.

(Whereupon, the above-entitled matter went off the record at 10:03 a.m. and resumed at 10:20 a.m.)

CHAIRMAN STETKAR: Okay, we're back in session and we continue with containment heat removal systems.

Rebecca?

MS. STEINMAN: The containment heat removal system for the US-APWR is a dual function ESF. The containment spray provides for fission product removal and containment cooling. The containment spray and residual heat removal systems share major system components such as the pumps and the heat exchangers. The containment spray is the focus of Chapter 6, while

the RHI shutdown cooling function is covered in Chapter 5 under Section 5.4.7.

The containment spray consists of four dual purpose RWSP suction lines, spray pumps, and heat exchangers. And the spray ring header is composed of four concentric interconnected rings.

Next slide, please.

The four dual purpose CS/RHR pumps are provided one for each of the four 50 percent capacity trains. They are motor driven, centrifugal pumps with mechanical seals. The pumps are sized to deliver 3,000 gpm at a discharge head of 410 feet.

The four CS/RHR heat exchangers are also provided. They are horizontal tube and shell-type heat exchangers and the core spray, RHR water system flows through the tubes at 1.5 E to the fifth pounds per hour and the component cooling water flows through the shell side with a design flow rate of 2.2 E to the fifth pounds per hour.

Next slide, please.

There are many discussions regarding GSI-191 in this section of the DCD. As we discussed earlier, GSI-191 will be the focus of the October 1st meeting.

Next slide, please.

So this slide provides an outline of the containment spray system. There are four 50 percent capacity trains containment spray using four dual-purpose containment spray RHR RWSP suction lines, the spray pumps and the heat exchangers. And the spray ring header has four concentric rings as are showed on this slide.

To ensure reliability of the containment spray pattern, each spray ring is located at a different containment elevation and the spray rings are supplied from the four 50 percent capacity trains of the containment spray. As a result of this header design, a single failure of one of the pumps does not result in a loss of a spray ring.

Next slide, please.

There are two open items associated with DCD Section 6.2.2. RAI 1036, Question 6.2.2-94 requested additional justification of the tube-side and shell-side fouling factors provided in Chapter 5 of the DCD. MHI provided this justification and we believe that the technical issue associated with this open item is closed pending staff's final review of the DCD.

The other open items associated with Section 6.2.2 is related to the pump operation under post-LOCA debris conditions and it is associated with

RAI 840-6096, Question 6.02.02-85 and this item will be addressed as part of the GSI-191 presentation October 1st.

CHAIRMAN STETKAR: Rebecca, when is it appropriate to ask you about NATB issues, later when you talk about fission product removal? Now?

MS. STEINMAN: I think later when we get to the fission product removal section.

CHAIRMAN STETKAR: Okay. I'll save it until then.

I will ask you one question and this relates to design. I think it's the time to ask this one. In Section 6.2.2.5 of the DCD, it says "narrow range containment pressure is indicated and alarmed in the main control room and the remote shutdown console. A single wide-range containment pressure transmitter provides indication to the MCR and RSC."

I have a few questions about that. And I couldn't find any of the information. I'm mostly concerned with information available to the operators. What is the displayed pressure range for the containment narrow range pressure transmitters? And what is the displayed pressure range for the containment wide range pressure transmitter, the one -- that you only have one of?

And because you only have one containment wide range pressure transmitter, I was curious there was only one of them. It's sort of related to what the pressure ranges are in terms of what information is available to the operators. So for example, if containment -- if the narrow range only gets you up to a few pounds, and you only have one wide range pressure transmitter and many of your LOCA analyses show pressures exceeding the narrow range, that doesn't sound like very reliable information for the operators for those LOCAs or steamline breaks. So that's the genesis of the question.

So I'm interested first in what are the display ranges on those transmitters and why you only have one and only one wide range transmitter?

MR. OGINO: This is Ogino speaking. Narrow range instrument range is 68 psig?

CHAIRMAN STETKAR: Sixty-eight?

MR. OGINO: Basically for maximum containment design pressure.

CHAIRMAN STETKAR: Okay.

MR. OGINO: And the wide range I forget the exact number, approximately 1.5 megapascal.

MEMBER BANERJEE: What is that?

CHAIRMAN STETKAR: I don't convert

megapascals in my head. 1.8 megapascal?

MR. OGINO: 1.5.

MEMBER BANERJEE: What is that in psi?

MR. OGINO: This is for the severe accident.

MEMBER BLEY: 220 psi, roughly, 230, something like that.

CHAIRMAN STETKAR: Okay.

MEMBER BLEY: A little more.

CHAIRMAN STETKAR: Okay, but the important thing is the two narrow range transmitters do go up to containment design pressure, 68 pounds. The narrow range, the upper end of the narrow range is 68 psig.

MS. STEINMAN: That is correct.

CHAIRMAN STETKAR: That's correct? Okay, thank you. Then I'm less concerned about there being only one right range. Thank you. That answers my questions.

MS. STEINMAN: Next slide, please. The US-APWR design does not utilize a secondary containment; instead, portions of the primary containment are enclosed by the containment penetration areas, which prevent direct release of the containment atmosphere. Under normal operating conditions, the containment penetration areas are serviced by the auxiliary building

HVAC system and under accident conditions they are serviced by the annulus emergency exhaust system which is automatically actuated.

The annulus emergency exhaust system maintains the containment penetration areas at a negative pressure during accident conditions.

This slide shows the penetration areas and the safeguard components rooms. The penetration areas which are shown in blue on this slide are located adjacent to the containment and include all piping and electrical penetration areas, except for the main steam and feedwater penetrations. These areas are completely contained within the reactor building and are designed to seismic category 1. The penetration areas are designed for the negative internal pressure that is provided by the operation of the annulus emergency exhaust system which is described in a little more detail on the next slide.

The safeguard component areas which are shown in yellow on this slide, are located adjacent to the containment and include ECCS components and containment spray components that are installed outside of the containment.

This slide provides a conceptual diagram of the annulus emergency exhaust system. The system

consists of two independent and redundant 100 percent trains in parallel with each train containing a filtration unit and a filtration unit fan. Each filtration unit contains a high efficiency pre-filter and a high efficiency particular air filter. The annulus emergency exhaust filtration unit fans automatically start on an ECCS actuation signal and direct flow to the vent stacks. The auxiliary building HVAC supply and exhaust lines are also provided with two dampers in series upstream of the four penetration area air handling units to ensure isolation of the event and in the event of a single active failure.

CHAIRMAN STETKAR: Before you switch, you speak very clearly and very fast and I can't keep up with you shuffling through my notes, so in Section 6.5.1.2, the annulus emergency exhaust system inlet and exhaust dampers are normally closed, right?

MR. OGINO: Yes.

CHAIRMAN STETKAR: The emergency inlet -- okay. They're indicated as electrohydraulic operators. If I look at figure 6.5-1 in the DCD, they're electrohydraulic operators and it's indicated that they fail in the closed position. Why are those dampers designed to fail in the closed position? It seems that I would really like them to open under emergency

conditions. And I recognize that they're redundant parallel dampers. And that one train is sufficient, but I don't know why they're designed to fail closed? Why aren't they designed to fail open for example? There must be some design -- why are they designed to fail closed?

MS. STEINMAN: We have somebody coming up to address this question.

MR. HOTCHKISS: My name is Marc Hotchkiss, representative of MHI.

I'm not sure of the exact design reason why they fail closed because you mentioned the system still accomplishes its safety function because of the dual 100 percent capacity emergency filter units.

CHAIRMAN STETKAR: Would it fail to accomplish its safety function if the dampers failed open?

MR. HOTCHKISS: I do not believe so.

CHAIRMAN STETKAR: So my question is why are they designed to fail closed?

MR. HOTCHKISS: We can take that back as a question to the designers.

CHAIRMAN STETKAR: Somebody had to make a decision and -- I tried to think of bypass blows or any -- I couldn't divine a reason why they would go closed

rather than open. But if there is one, I'd like to understand why that is.

I got confused by wording in the DCD. This is the correct configuration. There's one inlet damper to each train from the safeguards component areas and one inlet damper to each train from the penetration areas. Correct?

MR. HOTCHKISS: Yes.

CHAIRMAN STETKAR: The DCD seems to indicate that there's two parallel dampers from each of those suction sources, but the drawings are clear. Hang on a second.

Now, there was - -this is a long one. The SER raised a question about the time to reduce pressure in the penetration areas in the equipment areas after an accident. And apparently, there's an analysis done in MUAP-10020 that shows that the nominal time to establish the design negative pressure of a quarter of an inch water gauge in those locations is 180 seconds.

It also indicates that the time for the annulus emergency exhaust system exhaust fan to reach its design flow rate is 130 seconds. And the calculations in Section 5.6.1 and 5.6.2 of that MUAP specifically show that the difference in that time from

130 seconds to 180 seconds, that 50 second time is the time that's required to actually take pressure from its normal value down to negative .25 inches.

Now, if I take a design basis accident with a loss of offsite power, the design basis starting time for a gas turbine generator is 100 seconds. The annulus emergency exhaust fans are powered from motor-controlled centers that remain loaded, so they're not affected by any of the load sequencing on the gas turbine generators.

My question from all of these analyses is does the cited 180 second time to reduce pressure account for the time to start the gas turbine generators. In other words, I'm not sure whether the 130 second time that's cited in MUAP-10020 that's cited as the time for the fan to reach its design flow rate, is that the time for the fan, once I put electricity to the fan motor for the fan -- these are pretty big fans, to get up to full-rated speed, or does that 130 seconds also include the 100 seconds to start the gas turbine generator? Because if it doesn't, then I've got 100 seconds plus 130 seconds which is 230 seconds already, plus 50 second drawdown, it's now 290 seconds which is more than 180 and in fact is more than 240 seconds which is assumed on the LOCA analyses and in the tech specs.

So my question, if you understand it, it's kind of roundabout, is how do all of these timings work out with the sequencing of time zero, the accident happens, start the gas turbines, get the gas turbines up to speed so that they can energize the bus, get the fans started and running, get the fan up to speed to sufficient flow so that it can then draw down pressure within what at least is shown in the MUAP as an additional 50 seconds.

And do all of those sequential times meet either the 180 seconds that's listed in the MUAP or 240 seconds that's included in the accident analyses? You probably don't have an answer to that right now. But I'd like to understand that a little better.

MS. STEINMAN: I believe that we understand the request, but you are correct --

CHAIRMAN STETKAR: It's pretty convoluted.

MS. STEINMAN: We don't have an answer right now, but we understand the request and we can get an answer.

CHAIRMAN STETKAR: Okay, thank you. Let me just see if I had anything else on the -- my notes are as scattered as the documentation.

I don't have anything more on annulus exhaust. Anybody else, any other subcommittee member?

Okay, thanks.

MS. STEINMAN: So now we're moving on to the containment isolation system. And the containment isolation system allows for the free flow of normal or emergency-related fluids through the containment boundary in support of reactor operations, but establishes and preserves the containment boundary integrity.

The containment isolation system includes the system and components including the piping, the valves, and the actuation logic that establish and preserve the containment boundary integrity.

The criteria for the isolation requirements associated with the system design are set forth in GDC 54, 55, 56, and 57. The US-APWR containment isolation system is designed to seismic Category 1, Quality Group B. The containment isolation valves are identified as equipment Class 1 or Class 2 as described in DCD Chapter 3, Section 3.2.

The containment penetration barriers consisting of the flange closure, the personnel airlock, and the equipment hatch are under administrative control to ensure that they do not impact the containment isolation.

CHAIRMAN STETKAR: Here's another question

about timing. The -- let me see if I can phrase this a little bit better.

This is from the SER, but I'll ask MHI because it's a system design question actually. In the SER, it says the staff reviewed the design requirements of the containment isolation system as described in the DCD against the acceptance criteria for those provisions contained in Standard Review Plan Section 6.2.4, Subsection 2 of the SRP and has confirmed that as described in DCD Sections 8.3, on-site power systems and 8.4, station blackout, there is alternate AC power supply available within 100 seconds which will allow closure of containment isolation valves which will be open at the onset of an SBO. So the SER concludes that you meet the design requirements because AC power will be available to close valves within 100 seconds.

Now, if you look at Section 8 of the DCD, the electric power systems, the alternate AC gas turbine generators are designed to reach rated speed and voltage within 100 seconds, as are the normal emergency gas turbine generators. The AAC, alternate AC gas turbine generator start automatically, but they're aligned to the safety buses manually.

And the station blackout analyses account

for a 60-minute, not 60-second, 60-minute time for those alternate AC gas turbine generators to supply power. So during the cited station blackout conditions where by definition I only have the alternate AC gas turbine generators, it's not clear to me how I get power to containment isolation valves within 100 seconds. It would seem to be 60 minutes.

So my question from the design perspective is does the US-APWR design contain any normally open, AC motor operated, containment isolation valves that must be closed within less than 60 minutes after a station blackout occurs? Now if the answer to that is yes, I don't know how you meet the criteria, but I don't know. I didn't go through every penetration to look at what valves are motor operated, what valves are normally open, whether the motor-operated valves are AC or DC controlled, etcetera. That again, you can't answer the question right now I suspect. I was going to ask it to the staff, but you understand why I'm asking you because it's actually a design-related issue.

MS. STEINMAN: We will look at the list and confirm this and get back to you.

CHAIRMAN STETKAR: I mean if the answer is no, then I don't care.

MS. STEINMAN: I'm pretty sure the answer

is no, but --

CHAIRMAN STETKAR: I've been surprised in the past. Okay.

MS. STEINMAN: Have we confirmed that the answer is no?

MR. SPRENGEL: I think we'll go ahead and take this back and follow up based on the resources we have available, but our initial impression is that they're DC powered.

CHAIRMAN STETKAR: That may be true. As I said, I didn't go through every -- there's a lot of penetrations. I don't know even know which ones are normally open or not. So thanks. I appreciate that. That's all I had on containment isolation. Anybody else have anything on containment isolation? Speak up.

Next topic?

MS. STEINMAN: Next topic is combustible gas control in containment. The containment hydrogen monitoring and control system consists of two subsystems, the hydrogen monitoring system and the system ignition system. The hydrogen monitoring system consists of one monitor that is located outside containment and it measures the hydrogen concentration in the containment air that is extracted to the radiation monitoring system containment air sampling line. Once

the sampling valves are open, the hydrogen concentration is continuously indicated in the main control room.

MEMBER BANERJEE: Is there any monitoring within containment at all or do you just have the ignition systems?

MS. STEINMAN: The answer is no, there is none.

MEMBER BANERJEE: There is none?

MS. STEINMAN: There is no monitoring within containment.

CHAIRMAN STETKAR: The monitoring actually comes off the post-accident containment atmosphere sampling line, right?

MS. STEINMAN: That is correct.

MEMBER BANERJEE: And all that's being done, right? What's the logic for that that you don't need to know what's happening inside containment? It would seem that if you look at the past, often we haven't known what's in containment. We've been guessing. So we will continue to guess? Just informationally, it would seem prudent to put something inside as well. Is it not required due to some regulatory thing like a guide or something?

MS. STEINMAN: The system that we have in place meets the regulatory requirements right now.

it's a non-safety-related system.

MEMBER BANERJEE: It seems to me that one of the big unknowns has always been how much hydrogen there is in there. We've been guessing and looking at pulses and their explosions in the past. We've never had a clear idea. Mitsubishi just wants to conform to the regulatory requirements? Is that sufficient?

MS. STEINMAN: We believe that the system that we have --

MEMBER BANERJEE: You believe? Why do you believe that?

MR. GEORGE: That system does monitor the in-containment concentration. That is it is sampled from the inside containment.

MEMBER BANERJEE: But it's a well-mixed -- we are hoping it's well mixed?

MR. GEORGE: That's right.

MEMBER BANERJEE: It may be poorly mixed. We have no idea. Hydrogen could be stratifying and going to the dome for all you know. You could have local concentrations which are well above ten percent unless, of course, your calculations don't indicate that, but that may not have any relation to reality.

MS. STEINMAN: Right, and I believe those calculations were performed in support of determining

the location of the igniters which are used to reduce the hydrogen concentration.

MEMBER BANERJEE: Right, but as you know, we are very poor at doing calculations with stratified gases. I mean if you look at what's happening, happened at PANDA, the calculations where they did helium injection, this is not our strong point. Even with CFD to do this.

While I can sort of -- you meet the regulatory requirements for the calculations, but that doesn't mean there's any relationship to reality.

MR. SPRENGEL: Is there a specific request you'd like us to respond to?

MEMBER BANERJEE: No, I'm just asking are you so sure of this that there will be no accumulation in some region, particularly in the dome that you don't feel that you would even want to put a monitor? You know, when I run batteries in my lab, I put hydrogen detectors, even though there are no so-called hydrogen releases on the roof of my lab. Just because I'm a prudent fellow. So I would think that a reactor should be even more prudent. And I put them at -- because even at one percent I start to worry, right? This is reality. So it would seem to me that it would be prudent to put some monitors in the dome regions. It's not necessary,

but I think -- because you meet the regulations does not mean you meet the requirements for just trying to be as prudent as possible.

MR. SPRENGEL: We'll take that back under advisement.

MEMBER SCHULTZ: We'll get into some further discussion associated with this, but do you have -- you have a single-point system.

MS. STEINMAN: That's correct.

MEMBER SCHULTZ: And you have timing associated with it that depends on an action of manually opening containment isolation valve.

MS. STEINMAN: That is correct.

MEMBER SCHULTZ: So the general question is do you feel that in the event of a severe accident that this is a sufficient system to give you indication of containment of hydrogen that would prevent aspects of deflagration and other things that might happen.

MR. SPRENGEL: So the question is do we feel the regulations address that? Because it's been acknowledged that we're following the existing guidance, so I guess -- is any of the staff available to speak to --

MEMBER SCHULTZ: Well, you have your own particular system. You've done subcompartment

analyses and you're looking at severe accident analyses as well. Based on the results of those evaluations, do you feel what you've proposed here is sufficient for hydrogen indications? Because you really want to help the operator, just a general question.

MEMBER BANERJEE: Well, if you want to phrase it slightly differently, how confident are you that there won't be stratification do to plumes of hydrogen that may arise and that will be captured in dome region where you might get higher than the mixed mean concentrations? And the reason that this is a good question is the information we have about plume mixing, it's a very complex phenomena and these buoyant plumes can actually be very hard to mix, particularly if they're just sort of emanating and going up the roof regions which is why I was asking you how you ensure a well-mixed containment? Do you have fans or how do you do it? I have no idea.

Without going through your calculations for the mixing in detail which if you want, we can take a very close look at, if you want to stand up to that scrutiny, it would be easier just to put something and measure it. That's all we're saying, I think. Otherwise, we can go into this in as much depth as you want to see how well you can defend your mixing in the

containment because the problem is related to mixing. Because also what you're sampling assumes a well-mixed containment. You've done no CFD studies from what I understand. You relied on GOTHIC. You've only nodalized the dome region, right?

MR. OGINO: That's correct.

MEMBER BANERJEE: We can ask you to look at PANDA and see how well you predict PANDA with this.

MR. GEORGE: GOTHIC has been used --

MEMBER BANERJEE: Predict PANDA?

MR. GEORGE: PSI uses GOTHIC extensively.

MEMBER BANERJEE: Can you make that available to us to look at that?

MR. GEORGE: We have it in papers that have been presented by PSI. We can make those available to you.

MEMBER BANERJEE: That would be a start.

MR. GEORGE: Those were certainly more detailed though than the models that were used for the MHI containment. I believe that there was some information about the mixing of the thermal mixing contained in the Section 19 of the DCD.

MS. STEINMAN: There were analyses performed to support the determination of the number of igniters that were needed in their locations and as

part of Chapter 19, the types of calculations that you were discussing would have been input to those decisions.

MEMBER BANERJEE: One of the concerns and I think I should be quite clear about this is that if the plume is not very turbulent and this is low Reynolds number plume, they mix very poorly and once they're stratified, it's very hard to mix them. So because you've got a lighter gas on top of a heavier gas. So it's not an easy thing to do, you know, and that's really -- it would be interesting now you say Chapter 19 has been talked about already and I wasn't here. But that doesn't mean that we can't revisit it.

MS. STEINMAN: Understood.

MEMBER BANERJEE: You know and look into it in detail. All I'm saying is if you've got some monitors, at least, you know what's going on. These calculations are very, very difficult, believe me.

MS. STEINMAN: I believe we understand your stated position.

MEMBER BANERJEE: Yes. An whatever is in the regulations may or may not -- it's always a compromise, but it would be very hard to prove that you can actually predict these accurately without going into perhaps the psi level of nodalization which could be

very, very fine. In the end, GOTHIC just does the same as any CFD code would do. So if you nodalize it sufficiently finely, yes, you probably get roughly the right numbers, but it depends on whether you did that. I have expressed my views on this. We will hopefully revisit Chapter 19 at some point.

CHAIRMAN STETKAR: Yes. We're going to have a separate briefing on updates to the PRA, but I don't know whether we can raise it during that, but probably not. We get another shot at the entire safety evaluation during phase, I always forget, four?

MS. STEINMAN: Four or five.

CHAIRMAN STETKAR: Four or five, something like that.

MR. SPRENGEL: We can definitely have a separate discussion on this. We would support that discussion. I guess we'd have to have some interim discussion with the staff. I guess the request is acknowledging meeting existing --

CHAIRMAN STETKAR: I think we all understand what we're all talking about.

MR. SPRENGEL: We can discuss those in more detail at a --

MEMBER BANERJEE: But the existing regulation simply asks you to -- I would imagine predict

that the hydrogen distribution and put the igniters and things in response to that, right? So we can look into how you did that calculation still, right?

MS. REYES: I only wanted to say and it was mentioned this was discussed at the September 18 ACRS meeting back in February, this was an open item. It was on the hydrogen detonation and it also involves Chapter 6. Unfortunately, the reviewer is on rotation outside the division, so he couldn't support this at this meeting. I can always check at the break and talk to this reviewer.

I'm also the Chapter 19 PM. It's my understanding that this open item is now closed. I can check that when I go to my office. but I can always try to talk to the staff later today at one of the breaks.

CHAIRMAN STETKAR: Why don't you see if you can do that, Ruth, that might help because as I said it's a two-day meeting, so we have a little bit of time to follow up on some of these questions.

MEMBER BANERJEE: Do you have a reviewer who had left this as an open item, but recently it's been closed, is that it?

MS. REYES: Correct, it was closed. Again, if I remember correctly, it was closed after the ACRS meeting.

MEMBER BANERJEE: That would be helpful to know.

CHAIRMAN STETKAR: Let's just leave it at that for now.

MEMBER REMPE: It was related to the equipment would survive the environments during the hydrogen burn.

CHAIRMAN STETKAR: Is that what the open item is? So that's not really what Sanjoy is asking.

MEMBER REMPE: Right.

MS. REYES: Yes, that was one of my questions because we were asking about mixing the Chapter 19 was specifically on hydrogen detonation.

MEMBER REMPE: It could be part of Sanjoy's question because --

CHAIRMAN STETKAR: That's fine. It's now 11 o'clock. I want to see if I can get us at least a little bit on schedule here.

Rebecca, why don't we -- unless there's other questions about this issue, we've got a couple of either short term or more interim term follow-up things. Go on to the next slide. The reason I wanted to get to this is this next slide may help the previous discussion.

MS. STEINMAN: This slide discusses the

hydrogen ignition system and this system is responsible for -- is designed to limit the combustible gas concentration to less than ten percent by volume.

MEMBER BANERJEE: But based on mixed mean ten percent? Or is it ten percent LOCA?

MS. STEINMAN: It's a mixed value.

MEMBER BANERJEE: Okay.

MS. STEINMAN: It consists of 20 hydrogen igniters powered by non-Class 1E GTGs. Eleven of these igniters are also powered by dedicated batteries in addition to the alternate AC source. The batteries are capable of supplying power for at least 24 hours.

MEMBER BROWN: Before you go on, why 11 as opposed to -- is there a technical basis for only needing battery backup for 11 of the 20 igniters? I looked in the DCD and couldn't find.

MS. STEINMAN: I believe that was discussed as part of the Chapter 19 RAI response.

MEMBER BROWN: Do you know what the answer is?

MR. SPRENGEL: There was an evaluation done to determine both the amount of igniters needed and the specific igniters needed.

MEMBER BROWN: That you needed to have the additional backup on the batteries?

MR. SPRENGEL: At a minimum, correct, yes, it is. Yes.

MEMBER BLEY: Is that based on one particular accident? Do you remember? We haven't talked about that yet.

MEMBER BROWN: There's a discussion about distribution of these, the subcompartments and --

MEMBER BLEY: There's isolation between subcompartments.

MR. SPRENGEL: This was part of the item that Ruth was mentioning, but this has not all been completed by our presentation at the last meeting.

CHAIRMAN STETKAR: Right, Chapter 19, this was in a state of flux at that time. So in terms of subcommittee members' confusion, you're justified as being confused.

MR. SPRENGEL: Right, so subsequently, this evaluation has been completed and provided to the staff. I think we'll take that as an action to provide that reference.

MEMBER BLEY: So this isn't a design issue. Somehow it's a PRA issue. Is that what you're saying?

CHAIRMAN STETKAR: Chapter 19 is severe accidents.

MEMBER BLEY: That's true.

CHAIRMAN STETKAR: So by definition it's not a design basis issue.

MEMBER BLEY: Fair enough.

CHAIRMAN STETKAR: So they dump all of that into Chapter 19, so that's why it's addressed in Chapter 19. It's not a PRA in a sense. Chapter 19 covers severe accident issues. So design features that are strictly associated with severe accidents are covered in Chapter 19.

MEMBER BANERJEE: What's the logic? They must select certain sequences to guard against something, right?

CHAIRMAN STETKAR: In principle, the RAI response addresses that, I guess.

MEMBER BROWN: The DCD talks about being distributed to these 20 within not only the main containment, but within the subcompartments as well which there's no discussion what's the level of isolation between them and therefore how many are left or how the selection is. So it was over our head, I guess.

MS. STEINMAN: This RAI response, because it happened after the last meeting was not incorporated into the version of the DCD that you are reviewing right now.

MEMBER BLEY: Is the implication of this you could pull out nine of the igniters from your design? Is there any other requirement that has them in there? I mean you're only protecting 11 of them against the cases where you might conceivably want them.

MS. STEINMAN: And the 11 would be the minimum number that you need to address the particular conditions that were evaluated.

MR. SPRENGEL: Right, this is a specific Chapter 19 scenario that we're talking about for the minimum 11, and it is tied to identifying the battery power needed. So I'm going to maintain the action to get the reference so that we can all be speaking to the same point. And this is completely removed from like the Chapter 6 perspective.

MEMBER BLEY: That's good. We'll pick that up later. My question is are there any other accidents for which those other nine do you any good at all?

MR. SPRENGEL: And I am going to delay, I have a guess on that, but I'm going to delay giving a specific answer and get the appropriate material for you.

MEMBER BLEY: Good.

MEMBER BANERJEE: So just as a question

following up a little bit on this, I imagine that these are distributed, these 20 into the open volume and some subcompartments, right?

MEMBER BROWN: Yes, they call that out. They don't say exactly what even in the DCD. They don't call out a list of numbers at each compartment. At least I didn't find it. I looked at the figure they referenced, but I didn't 6 point something or 5.2.1 or something like that. And it was very, very -- a couple of boxes and no -- very little definition in terms of specificity as to what was what and where. So I didn't see anything that was really pressing.

MR. SPRENGEL: I think there's been some changes on our specificity.

MEMBER BROWN: That would be nice.

MR. SPRENGEL: I would again delay discussion on that. That was identified by the staff as well.

MEMBER BANERJEE: I'm just trying to understand the logic though, the logic of how you've done this is you've identified the placement and the open spaces as well as those subcompartments where in some form, based on a PRA or something, where you might get high hydrogen concentrations. Is that the logic you followed in distributing them? I'm just trying to

understand how you pick the locations for these 20.

MR. SPRENGEL: Unfortunately, we lost our hydrogen people whenever -- they were on the phone earlier and we passed through the hydrogen and we lost them. So I can follow up on that and during this meeting we can get a response.

My understanding is that it is an iterative process of using MAP and GOTHIC to identify as you said I think the potential sources or higher LOCA concentration of hydrogen and then put the igniters in place.

MEMBER BANERJEE: And those sequences were picked from some of a PRA I would imagine, right? You'd have to know --

MR. SPRENGEL: The access scenarios?

MEMBER BANERJEE: yes, the scenarios that are used because how would you know where to put it without knowing something about the accident scenarios? So did you pick the most top ten, whatever, I don't know, scenarios and then look at how to located this? I'm just looking for a sequence in the logic, how you did -- went about this, you know?

MR. SPRENGEL: Jim Curry is on the line, if we could get the line opened up. I think we could do that, we would have a better chance of getting some

answers.

MEMBER BANERJEE: We are looking for the design methodology for placement of these.

MEMBER SCHULTZ: And where it's documented, Ryan. It sounds as if there's been a communication with the staff since we last --

CHAIRMAN STETKAR: Quite honestly, if the answer is all of these issues are addressed in that RAI response, we can look at that once we get it. If there's some indication that they're not, then we ought to get them on the table so that we get answers to them.

MR. CURRY: Can anybody hear me.

CHAIRMAN STETKAR: Yes, thank you very much. Jim, just identify yourself for the record?

MR. CURRY: Yes, thank you, Mr. Chairman. This is Jim Curry, MNES. The RAI that you're talking about is 71 --

CHAIRMAN STETKAR: Jim, you're breaking up really badly, so either move back from your microphone --

MR. CURRY: Let me try moving back.

CHAIRMAN STETKAR: There you go.

MR. CURRY: The RAI that you're referring to is 8716121.

MEMBER REMPE: Rev 1 or Rev 0?

MR. CURRY: It's a revised RAI, submitted April 25, 2013.

CHAIRMAN STETKAR: 2013? You're still breaking up a little bit.

MR. CURRY: Sorry, I'm not sure what the issue is.

CHAIRMAN STETKAR: It's probably on our end. I'll just alert you to the fact that you are. So we'll make sure the -- the staff, I'm sure is on top of this. We'll get the most recent revision of that RAI and get a response from the staff.

MR. CURRY: That's right, and I think it's the question of the logic, the location of the igniter, view of the most likely severe accident --

CHAIRMAN STETKAR: We lost you after "most likely severe accident" so could you repeat what you said, please?

MR. CURRY: Right, the logic for selecting the 11 was based on a PRA type approach of the most likely released agents, for example, the RCP seals. And it is a severe accident sequence, so this is not normal containment location of the igniters. Our view is we need all 20 to really --

CHAIRMAN STETKAR: We lost you again after you said "we need all 20" to do something.

MR. CURRY: To thoroughly blanket the containment, but 11 are picked for this severe accident sequence.

MEMBER BANERJEE: Is all this explained in the RAI, then we can do without the static.

MR. CURRY: I believe that you will find that it's well explained in the RAI.

CHAIRMAN STETKAR: That's the important piece because we can't get resolution in real time during this meeting. So as long as there's some confidence that these issues are addressed, in other words, a selection of the accident sequences and justification for why you need 11 and only 11 to satisfy the requirements for those accident sequences, we'll take that information and then ask the staff to make sure that we get the most recent revision of that RAI and the response and we can do some homework.

MR. CURRY: That's good. Thank you, sir.

CHAIRMAN STETKAR: Thanks, Jim.

MEMBER BANERJEE: Can we get that in real time, so that we can look at it tonight in case we have some questions tomorrow?

MS. REYES: Of course. I just want to ask is this Chapter 19 or Chapter 6 RAI?

MS. STEINMAN: This was a Chapter 19 RAI.

MS. REYES: That's what I thought. The slide wasn't provided.

CHAIRMAN STETKAR: Just make sure we will get it. And Jim, we're going to cut you off again because on our end we get all kinds of static, so you can listen in, but if you're screaming at the microphone we can't hear you.

MR. CURRY: Thank you. I'm communicating with Ryan, so he'll let you know if I need to talk.

CHAIRMAN STETKAR: Good, thanks a lot.

Rebecca?

MS. STEINMAN: All right, the final bullet on this slide simply says that this system is automatically initiated by the ECCS actuation signal, but of course, it may be manually initiated whenever it's needed.

MEMBER BROWN: Before you leave that is there a basis for why you do it with ECCS signal as opposed to just being generally energized?

CHAIRMAN STETKAR: So they don't burn out.

MEMBER BROWN: It says they were automatically initiated, I just wondered why the only time is when the ECCS is actuated and if it's because keep them energized, they'll burn out, that's fine.

CHAIRMAN STETKAR: Kind of like why you

don't keep a high head safety injection pump running constantly.

MEMBER BROWN: I'm not an igniter expert, so I asked the question. I thought the answer would be easily available.

CHAIRMAN STETKAR: Anything else on the igniters?

MEMBER BROWN: Okay, so there's no answer to that, is that correct?

MEMBER SCHULTZ: How do your igniters function?

MEMBER BLEY: Are they glow plugs, catalytic things?

MS. STEINMAN: Jim is the person who can answer that question.

CHAIRMAN STETKAR: He's shouting at the microphone right now. Okay.

MEMBER BANERJEE: I think the concern has always been wetness, so they have to be able to function under wet conditions.

MR. SPRENGEL: We can follow up on to the type and why they're not normally energized.

MS. REYES: John, we do have now the reviewer here. If the ACRS members have any questions related to this topic because he will have to leave soon.

If you have any questions specifically to the staff and the staff's review, this is the time.

MEMBER BANERJEE: Well, could we review the RAI and will you be here tomorrow or are you taking of?

CHAIRMAN STETKAR: Just identify yourself.

MR. O'DRISCOLL: This is Jim O'Driscoll. I'm with the Containment Ventilation Branch and I'll be here tomorrow. We can handle that --

CHAIRMAN STETKAR: It sounds like the best approach here for timeliness is if we can get the RAI response this afternoon sot hat we can look at it this evening and that might focus some of the questions. And Jim, if you're available tomorrow perhaps on call, we don't want you to necessarily sit here, but bring it up tomorrow.

MEMBER BANERJEE: But let's look at what's been submitted.

CHAIRMAN STETKAR: Thanks, Jim.

MS. STEINMAN: Moving on to the next slide. It simply states there are no open items for DCD Section 6.2.5 which is related to the combustible gas control.

Our next topic is containment leakage testing. The requirements are provided in 10 CFR 50 of Appendix A, GDC items 52, 53, and 54 and they require that the reactor containment vessel and the piping

systems that penetrate the containment be designed to accommodate periodic leakage rate testing.

Appendix J specifies the leakage testing requirements for the containment, its penetrations, and the isolation valves. This is Type A, B, and C tests.

The US-APWR leakage rate testing program implements the performance-based leakage testing requirements of 10 CFR 50 Appendix J, Option B using the specific methods and guidance provided in NEI 94-01 and ANSI/ANS-56.8-1994, as modified and endorsed by RG 1.163.

There are currently no open items related to this section of the DCD either.

The next topic is the fracture prevention of containment pressure vessel. The ferritic containment pressure boundary materials include the ferritic portions of the containment vessel; all penetration assemblies or appurtenances that are attached to the containment vessel, all piping, pipes, and valves that are attached to the containment vessel or penetration assemblies out to and including the pressure boundary materials of any valve required to isolate the system and provide a pressure boundary for the containment function.

The ferritic pressure boundary materials

meet the fracture toughness criteria and the requirements for testing that are identified in Article NE-2000 of Section III of Division 1 or Article CC-2000 of Section III, Division 2 of the ASME Code.

There are no open items associated with this section of the DCD either.

Next up we have the Emergency Core Cooling System. This slide provides a brief overview of the different subsections of the DCD, Section 6.3 for ECCS design and evaluation.

The Emergency Core Cooling System is designed to remove hat from the reactor core following a postulated design basis accident. The ECCS consists of the safety injection system which includes the accumulator, the high head injection, and the emergency letdown system.

The primary function of the ECCS is to remove stored and fission product decay heat from the reactor core following an accident. The safety injection function of the ECCS ensures adequate coolant availability to perform this function. The primary function of the ECCS with respect to safe shutdown is to ensure a means for feed and bleed for voration and make up water for compensation of shrinkage. Certain portions of the ECCS operate in conjunction with other

systems to ensure that safe shutdown is maintained.

With respect to containment pH control, sodium tetraborate baskets are located in containment and are capable of adjusting the pH of the recirculation water to at least 7 to enhance the iodine retention capacity and to avoid stress corrosion cracking of the austenitic stainless steel components that are located in containment.

The ECCS design features include four independent and dedicated 50 percent capacity SI pump drains and four passive accumulators with one supplying each reactor coolant cold leg. The US-APWR employs direct vessel injection from the SI pumps via the nozzles connected to the reactor vessel in the reactor cavities of the compartment. The RWSP is located inside containment, thus eliminating the need to switch over the ECCS section from an external source to the containment recirculation sump.

The emergency letdown system provides redundancy to the normal CVCS system for achieving cold shutdown voration conditions. And as previously discussed, NaTB is provided for post-accident pH control.

CHAIRMAN STETKAR: Now I'm going to ask my NaTB question unless you tell me it's pertinent

someplace else. In the -- we discussed this, I think, once before, but I wanted to bring it up now because the analyses that I've seen and in Section 6.3.2.2.5 of the DCD indicate that it takes about -- it takes approximately 12 hours to dissolve the NaTB.

We raised a question during some earlier meeting about operator actions to prematurely terminate containment spray because normally the emergency operating procedures instruct the operators to terminate containment spray when containment pressure gets down to normal or within some range. That would occur obviously well before 12 hours for any event that I can think of. And the response we got at the time is well MHI indicated that the EOPs would be revised to instruct the operators to maintain containment spray flow for long enough to ensure that the NaTB is dissolved.

My question is how do the operators now know when they should shutoff containment spray flow? I mean you don't have a pH monitor. The 12 hours seems to be some sort of -- it's probably a calculated value on the presumption of 2 and only 2 containment spray trains operating which is the design basis analysis.

My question is how do the operators at this plant know how long they should run containment spray

to satisfy everything, containment pressure response, adequate dissolution of all of the NaTB to make sure that I've got the right pH in the RWSP and so forth?

I realize it's an operational question, but we are concerned here about guidance to the operators under stressful conditions.

MR. SPRENGEL: I understand. The first thing, we don't have EOPs developed for this plant. So I think there were some discussions about the guidance documents that will be provided for creating the EOPs, but your question still definitely remains.

For the record, I want to be clear though --

CHAIRMAN STETKAR: Recognizing that the COLA, the COL, the eventual licensee develops the procedures themselves.

MR. SPRENGEL: Beyond that though, I'm going to have to take that away and follow up on it.

CHAIRMAN STETKAR: Okay, I just want to make sure that whatever guidance is developed by the designer of this plant and you're right, I'm not correct to call that EOPs, but you do supply the guidance document and the background information for all of this, the eventual development, pretty clearly addresses this

issue because we danced around it a couple of times and in -- the reason I brought it up again in DCD 6.2.2.2.2, it says explicitly following a design basis accident containment pressure approaches atmospheric pressure. When the containment pressure is reduced sufficiently and the operator determines that containment spray is no longer required, the operator terminates containment spray. The operator closes containment spray header isolation valves, does other things.

My question is how does the operator determine when containment spray flow is no longer required, because it's not only pressure.

MR. SPRENGEL: I agree.

CHAIRMAN STETKAR: Thank you.

MS. STEINMAN: Next slide, please. So the slide currently showing on the screen provides an overview of the four independent trains at ECCS which include the four vertically-mounted cylindrical accumulators located outside each SG reactor coolant pump cubicle and those are shown at the top of the slide.

Four safety injection pumps that take suction from the in-containment RWSP and directly inject into the vessel via the nozzle connections that are located in the reactor cavity. Two emergency letdown lines that direct reactor coolant to the spargers in

the RWSP. The emergency letdown lines are provided -- the two of them are provided one from each hotleg for leg A and leg D.

The in-containment refueling water storage pit or RWSP --

CHAIRMAN STETKAR: Before you -- if you go back there, this unfortunately, I was searching for the drawing, but I'll just refer to it, the safety injection system and there were RAIs about this, but I'm still a bit confused. Figure 6.3-3 in the DCD shows the safety injection system piping elevations. And the piping has a high point inside the containment, I think as best as I can tell. If I can -- bear with me a moment so that I actually -- pull up the drawing I can tell you where it is and I might be wrong.

(Pause.)

The drawing 6.3-3 shows what seems to be a high point between the outside containment there's motor operated isolation valve that's normally opened. Then inside containment, there's a check valve and another motor operated isolation valve. Between the check valve and the in-containment motor operated isolation valve, there's a high point and it's pretty clearly shown on this drawing.

From that high point, there's a takeoff for

the safety injection pump test line. My concern is accumulation of gas and the staff did, in fact, have several RAIs regarding this topic. There's in the SER, it refers to the response to an RAI 464-3520, Question 05.04.07-11 that apparently addressed venting. And it mentions a technical specification surveillance requirement 3.5.2.7 that was added to verify that ECCS location susceptible to gas accumulation are sufficiently filled with water. It says "in addition this area, susceptible to gas accumulation, is dynamically swept quarterly to the RWSP by the in-service testing program."

Now I looked at the in-service testing program and the in-service testing program seems to say that the pumps are tested either with the pump minimal flow or full flow piping, loops. So I have questions. What confidence to I have that quarterly testing through, for example, the minimum flow line will sweep accumulated gases out of this piping? There are requirements to say the system is vented prior to plant startup. That's fine, I can do that. This is inside the containment, so it's not readily accessible during plant operation. During plant operation, I might have maintenance events. I might have all kinds of things that can introduce gas into this line outside

containment. And because this is the high point in the system, that gas is going to migrate there. Those valves are normally open.

So the question is what analyses have been done to give me confidence that this quarterly operation through what might be the minimum flow line, might be the full flow line, I'm not sure which because it doesn't seem to specify will adequately give me assurance that that piping section is vented? I was going to ask a design question. I don't know why that high point is located where it's located at the one point that I probably can't get to to periodically vent it, but given the fact that that's the design and somebody made that decision, I'd like some confidence about the ability to provide assurance that it's vented.

MS. STEINMAN: I believe there's an on-going side discussion over here and they will have the answer in just one moment.

(Pause.)

CHAIRMAN STETKAR: As usual, by the way, if we can't get something really quick, we can -- we still have a day and a half.

(Pause.)

MS. STEINMAN: There's not a specific analysis. This is -- the figure that you're referencing

doesn't show the detail of that line.

CHAIRMAN STETKAR: That's exactly right.

MR. SPRENGEL: So the line itself is inclined to collect the gases at the high point so that when you do flush it out, it's not kind of bubbles that are throughout it, it's actually collected at the high point of that line.

CHAIRMAN STETKAR: Okay.

MR. HAMAMOTO: This is Hiroshi Hamamoto from MHI. Basically, pump discharge line is sloped to the high point. We jumped the discharge lines. That is our engineering judgment.

CHAIRMAN STETKAR: Okay, well, engineering judgment is one thing. Confidence that indeed gas will go where you want it to go and not stay where you don't want it to stay is something else.

Could we -- if, for example, you're right, it only shows that the test line comes off what is clearly indicated as the high point in the system. What I'd like is a little bit better information that indeed any gsa that's introduced into that discharge line is somehow -- I hate to use the term guaranteed, because nothing is guaranteed, but what is the basis for high confidence that indeed the gas will collect in the location that will be swept out when I perform that test?

So it's not only the configuration of the discharge line itself, it's also the configuration of the test line and the amount of flow that's put through that test line. You wouldn't want the test line to come off the bottom of the pipe for example.

MR. SPRENGEL: Is the question on collecting the gas or discharging it?

CHAIRMAN STETKAR: It's primarily discharging it from my perspective. You're effectively taking credit for a periodic test of the system to give you assurance that any collected gas will be swept out of the system. So part of it is the collection part that indeed the gas will collect at the location you expect it to collect and no other place. And then the secondary part is the assurance that the periodic test will effectively sweep that gas out of the system and discharge it back into the RWSP. So I'm not quite sure that it's as distinct as collection versus sweeping, but it's really both of those issues.

MR. HAMAMOTO: We already discussed about discuss about some possibility portion in RAI.

CHAIRMAN STETKAR: Okay, maybe if it's that RAI that I cited, maybe we can get a copy of that from the staff who has disappeared. Just make a note of it. It's RAI -- unless there's an additional one, the one

that I found was RAI 464-3520, in particular question 05.04.07-11. That's what was referred to in the SER. If there's additional information in another RAI response, I'd appreciate the information. We can make sure we get that particular RAI from the staff and that will give us an opportunity to read a little more details. Okay. Thank you.

MEMBER REMPE: John, while you're writing your notes, just to briefly go back to this hydrogen issue, again, it's been a while and I've forgotten things, but I found the ERI report and they did do some more conservative calculations. There were interactions between them and the licensee.

Sanjoy, there was an ERI report about the hydrogen issues in mixing and Khatib Rhabar was here when we had this discussion and he had actually used an ERI-specific code to look at ignition. He had identified ways to further enhance the amount of hydrogen produced beyond what was in MELCOR or MAP by considering steel of oxidation along with the zircaloy oxidation. He looked at areas where hydrogen might collect and due to condensation and the refueling water storage pit. There were interactions between him and MHI where they did more refined GOTHIC analyses and at the end of the day everybody concluded that it was a

very low potential for ignition to occur.

I can send you -- I think that report might actually be very helpful in your deciding whether any further activity needs to occur in this area.

MEMBER BANERJEE: This is the ERI report?

MEMBER REMPE: I found it much more useful than the documentation that was provided to us. We actually had to ask the staff for it to get it. It's proprietary so I'm just going to give you on a jump drive. But I'll get it to you today.

MEMBER BANERJEE: All right. Good, thank you.

MEMBER REMPE: I had forgotten, so I had to look up and find the report.

MEMBER BANERJEE: You and Mike were here for the --

MEMBER REMPE: I was here. I can't remember if Mike was here for all of it. Again, I had trouble remembering if the report was found. I had to dig through. Bill Shack was here with me. I do know that.

MEMBER BANERJEE: You did your due diligence.

MEMBER REMPE: We tried, but we're never as diligent as you are.

(Laughter.)

MEMBER BANERJEE: Thanks.

MS. STEINMAN: The slide we have up is related to the in-containment refueling water storage pit that is located at the elevation of 3 foot 7 inches and the lowest part of the containment. This area provides the continuous suction source for those safety injection and containment spray RHR pumps. As stated previously, this configuration allows for the elimination of the suction switchover of the US-APWR. The lefthand figure on the bottom of this slide provides a plain view of the RWSP which is shaded blue. The RWSP is a horseshoe-shaped box around the perimeter of the containment with the open end facing plant north. The lefthand figure shows a section view of the RWSP.

MEMBER BANERJEE: Where does the recirculation pumps draw from?

CHAIRMAN STETKAR: If you use the mouse, it's a little bit easier.

MS. STEINMAN: There you go. So these are the strainers.

MEMBER BANERJEE: Okay, so what happens to the water? Does no water get below -- if you take a smaller view? I'll show you what I mean. So there's this sort of cavity below the reactor and all that region

there. Is there any water that accumulates around the bottom of the containment there?

MS. STEINMAN: Yes.

MEMBER BANERJEE: So that water gets out of circulation then?

MS. STEINMAN: Yes. There is an ineffective pool in that area.

MEMBER BANERJEE: Okay, so a certain amount of water.

MS. STEINMAN: There is a certain amount, yes. And the specific volume of that amount of water will be described in the GSI-191 meeting.

CHAIRMAN STETKAR: That's what I was going to ask. We'll talk about all of what you call hold-up volumes.

MS. STEINMAN: Yes.

CHAIRMAN STETKAR: I have questions about levels in the RWSP that's appropriate for the GSI-191 or is that for today?

MS. STEINMAN: That would be a good time to talk about that.

MEMBER BLEY: We haven't seen this for real. When we have a dry area in the sump area, the containment, it's really easy to inspect it to see if anything has gotten in there. What kind of facilities

are provided for the plant staff to make sure that this combination sump and refueling water supply don't get debris in them during work in the containment, that sort of thing? Is the cover over very different than a -- is it a grating kind of thing or what's over the top of it?

It seems like stuff could get in there and might be hard to spot. We can wait until the next meeting to talk about that.

MR. GEORGE: This is a solid concrete above it with vent pipes that have elbows on them.

MEMBER BLEY: So the water comes into it up through an inverted U tube essentially.

MS. STEINMAN: There are drain paths and there are debris interceptors associated with those drain paths and those details are also going to be included in the GSI-191.

MEMBER BLEY: But in general there's no easy path to get in there for stuff dropped during maintenance.

CHAIRMAN STETKAR: I think Dr. Bley is not talking about debris from --

MEMBER BLEY: I'm talking about workers.

CHAIRMAN STETKAR: Hard hats, wrenches, Jimmy Hoffa, that type of thing.

MS. STEINMAN: The RWSP does have a solid ceiling associated with it, so you know, just a random drop in containment isn't going to drop down there. And then in terms of the other areas, we have these debris interceptors so that in the case that that debris exists there and water could push it. We have accounted for that by the interceptors to prevent it from getting into the RWSP. And there are also design considerations in terms of the debris loadings that are determined for GSI-191 that takes some of that into account, but all of that will be discussed at the October 1st meeting.

MEMBER BLEY: I have a question coming up and half of it will be is it covered in GSI. John, we haven't done the safety analysis yet, have we?

CHAIRMAN STETKAR: 15, yes.

MEMBER BLEY: We have. Since I didn't have a picture of this thing, Sanjoy or Joy, did any of you look at the thermohydraulic calculations and see if there's any kind of suction issues following a LOCA with getting the expected flow into this since it's coming in through --

CHAIRMAN STETKAR: That's GSI-191. All of the --

MEMBER BLEY: All of that got put off to there. Good enough.

CHAIRMAN STETKAR: Getting water and material, positive suction, all of that is -- it's going to be a really busy day.

MEMBER BANERJEE: We shouldn't plan --

MEMBER BLEY: An early departure.

CHAIRMAN STETKAR: We'll talk about that at the closeout of this meeting.

MS. STEINMAN: Would we like to move on to the next slide?

CHAIRMAN STETKAR: Yes, please.

MS. STEINMAN: The next slide is regarding the advanced accumulator. The accumulators are passive devices filled with boric acid water and charged with nitrogen. The accumulators discharge into the reactor coolant leg when the cold leg pressure falls below the accumulator pressure. As shown on the lower right-hand side figure, the accumulators incorporate an internal passive flow damper which functions to inject large flow to refill the reactor vessel during the first stages of injection and then reduces the flow as the accumulator water level drops. When the water level is above the top of the stand pipe, water enters the flow damper through both the inlets at the stand pipe as well as the side inlet of the flow damper and injects water with a large flow rate. When the water level drops

below the top of the stand pipe, the water enters the flow damper only through the side inlet and therefore injects water with a relatively low flow rate compared to the previous flow rate.

As a result of the flow damper configuration, the accumulators for the US-APWR function as the low head injection system. Since the accumulator design extends the period of injection, there's more time available for SI pump start, allowing the US-APWR to adopt GTDs for emergency power.

The entire day tomorrow is going to be devoted to the advanced accumulators and so in the interest of time, hopefully, we can push any questions on this system off to the detailed discussion tomorrow.

MEMBER BANERJEE: Tomorrow, the staff will present as well, right?

MS. STEINMAN: Yes. MHI presents in the morning and the staff presents in the afternoon.

CHAIRMAN STETKAR: Rebecca, I probably missed something here. Did you have a slide or did you cover the emergency letdown?

MS. STEINMAN: Not in significant detail.

CHAIRMAN STETKAR: Okay.

MS. STEINMAN: The emergency letdown line was shown on Slide 44, but we didn't provide a detailed

discussion.

CHAIRMAN STETKAR: I just had -- this is a simple question. If I look at figure 6222-1 in the DCD, Revision 3, that figure shows the emergency letdown lines originating at loop A and loop B. Section 6.3.2.1.3 of the DCD and some other drawings indicate that the lines are on loop A and loop D. And the SER says that the emergency letdown lines come from loops B, boy, and D. I'm just curious where they were connected because I've got three different sets of information that told me three different places. If I were a betting person, I know what I would bet on, but --

MS. STEINMAN: A and D.

CHAIRMAN STETKAR: A and dog.

MS. STEINMAN: Dog, yes.

CHAIRMAN STETKAR: Okay, so please from your perspective, clean up the DCD in particular that Figure 6.2.2-1 because that's the only anomaly that I could find in the DCD. And the staff ought to take note of that because they got it wrong also. Thank you.

MS. STEINMAN: So there are two open items that we're going to discuss today associated with Section 6.3. RAI 881-6203 Question 63104, requested incorporated of the SI pump functional qualification

into the ITAC associated with that system. This RAI is related to a Chapter 3 RAI, RAI 896-6269, Section 3.9.6-69 which addresses the functional qualification for all pumps, not just the SI pump.

Based on the staff feedback to date in association with the Chapter RAI response, it appears that the particular technical issue associated with this open item is closed pending confirmation of the DCD changes.

RAI 982-6036, Question 6.3-111 is where the staff asked for a hydrodynamic loading evaluation of the sparger system. MHI has agreed to perform this evaluation as part of the ITAC and has revised the DCD in accordance with the RAI response. We believe that this particular issue is closed as well, once the staff has an opportunity to confirm that the DCD changes were made appropriately.

The following slide shows an additional four open items associated with this section of DCD that are associated with GSI-191 and these will be discussed at the meeting in a few weeks. The topics involved in these open items are the Tier 2 designation of fibrous debris amounts; the Core Inlet Blockage impact on foreign precipitation; and the debris impact on long-term core cooling.

CHAIRMAN STETKAR: What I think makes sense because I know I had some questions about the main control room HVAC system, how that goes, I think it's probably best -- we're running behind schedule, obviously. I believe we have some margin built into our schedule, so I'm not too concerned about time. So I think it's probably best to break for lunch now and I'll ask the assembly whether we should reconvene at 1:45 or 1, any particular preference? I'll be generous. We'll reconvene at 1 o'clock.

(Whereupon, at 11:47 a.m., the meeting was adjourned, to reconvene at 1:00 p.m.)

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

12:59 P.M.

CHAIRMAN STETKAR: We are back in session.

We'll pick up with Section 6.4.

MS. STEINMAN: Well, the slide that we currently have showing is an overview of the different subsections for DCD Section 6.4 for the habitability system design and evaluation.

Next slide, please.

The habitability systems provide two functions, to allow the operators to remain safe inside the control room to take necessary actions to manage unusual, unsafe, or abnormal plant conditions, including a LOCA, and to prevent the operator from external release of radioactive material, toxic gas, or smoke which will enable the operators to maintain control room occupation for an extended period of time.

Next slide, please.

In order to support the previously two described functions of the habitability systems, the main control room HVAC system has several modes of operation. The two emergency modes of operation are the pressurization mode which protects the main control room operators and staff during the accident conditions and the isolation mode which protects the main control room operators from external toxic gas or smoke. These two modes will be described in greater detail on the next two slides.

For the rest of this slide, we can talk about the normal mode of operation for the main control room HVAC system.

In the normal mode of operation outside air is drawn in through either of two missile-protection grids and the tornado depressurization protection dampers. The incoming air is then directed to any two of the four 50 percent capacity and control room air handling units and one of the two 100 percent capacity main control room toilet or kitchen exhaust fans to exhaust a portion of the supplied outside air while the majority of the main control room ventilation air flow recirculates.

In the emergency pressurization mode of operation, automatic initiation establishes a control room envelope pressure that is higher than that pressure of the adjacent areas. A portion of the return air flow is directed to the emergency filtration units. The outside air is again drawn in through either of the two missile protection grids and the tornado depressurization dampers. Incoming air is directed to both 100 percent capacity main control room emergency filtration units and all four of the 50 percent capacity main control room air handling units.

The main control room smoke purge fan and the main

control room toilet and kitchen exhaust fans are shut down and isolated in this mode of operation.

CHAIRMAN STETKAR: Rebecca, before you leave that slide, I got confused reading DCD Section 9 and DCD Section 6. In Section 9, 9.4.1.1.1, it says that the emergency isolation mode -- I guess this is the next slide. I'll let you get to the next slide. I'm sorry. I was trying to do three things at once and failed on two of them.

MS. STEINMAN: Emergency isolation mode of operation, we have established full recirculation, without any outside air. The outside air intake isolation dampers are isolated and the return air is directed to all four of the 50 percent capacity main control room air handling units. The main control room smoke purge fan and the main control room toilet and kitchen are shut down and isolated, similar to what they were in the previous operation mode.

The control envelope access doors are administratively controlled to prevent them from being open during this mode of operation.

CHAIRMAN STETKAR: Now I can ask my questions.

MS. STEINMAN: All right.

CHAIRMAN STETKAR: In Section 9.4.1.1.1 of

the DCD, it indicates that the isolation mode is automatically initiated. It's also indicated as automatically initiated in Section 9.4.1.2.2.2. There seems to be indications in Section 6.4.3 that the emergency isolation mode is manually initiated. So I'm curious whether it's initiated automatically or manually. I'm hoping that this is a simple answer to a question because based on the answer to this question I may or may not have two or three other questions.

MR. HOTCHKISS: This is Marc Hotchkiss again. So the emergency isolation mode is initiated based on smoke detectors automatically.

CHAIRMAN STETKAR: Automatically.

MR. HOTCHKISS: On smoke detectors. And would be manually initiated for other reasons other than smoke.

CHAIRMAN STETKAR: But smoke is automatic?

MR. HOTCHKISS: Correct.

CHAIRMAN STETKAR: Thank you. Let me -- I'm still doing two things, one of which I'm doing successfully. The other one I'm not. That explains, because I think the context in Chapter 6 was discussing possible toxic gases or other things. Automatic for smoke. Manual for others.

Now, I'm glad to hear that because I can

ask another question now. There was a question I think the staff may have raised the question regarding the proximity of the main control room outside air intakes to the exhaust from the gas turbine generators. On every ECCS actuation signal, the gas turbine generators fire up, so you're going to get exhaust going out.

The question I had is if the exhaust from the gas turbine generators comes into the intake of the main control room ventilation system which ought to be then aligned for the pressurization mode as I understand it because it's an ECCS actuation, will the smoke detectors detect smoke and realign the system to the isolation mode which indeed doesn't align the -- doesn't include the filtration units. See what I mean? Is the system going to realign itself out of the pressurization mode because it detects smoke coming from the gas turbine generator exhaust? And if it's done automatically -- I don't know how those signals or whether there are priorities for those signals or how it works.

MR. HOTCHKISS: I can't answer the question. One overrides the other. I would say the design of the intakes is such that we wouldn't expect gas turbine exhaust to be inducted into the control room through those intakes first off. Whether or not -- if it did occur whether the smoke detectors would actuate.

I don't know that we've looked at that either, but I mean this is something we probably have to think through a little bit and look at the I&C to see if there's a preference to --

CHAIRMAN STETKAR: There's some indication, it says the minimum horizontal distance from the gas turbine exhaust to the main control room may track outside air intake is approximately 72 feet. That sounds like a long distance, but I don't know what the relative elevations are, for example, nor do I have any idea about air flow patterns or stuff like that.

I'd be curious, if for some reason the pressurization mode always overrides the isolation mode, then I think I'm okay. I'd appreciate some feedback on that.

MS. STEINMAN: All right, we can provide that feedback.

CHAIRMAN STETKAR: I looked. Chapter 7 doesn't have this level of detail on the I&C, so I couldn't find anything there.

MEMBER SCHULTZ: In the Chapter 15, a draw room dose analysis is the emergency isolation mode presumed in any case?

MR. HOTCHKISS: I would expect that the pressurization mode would be presumed.

CHAIRMAN STETKAR: The pressurization lines up the HEPA filters.

MEMBER SCHULTZ: That's what I expected.

CHAIRMAN STETKAR: The isolation mode doesn't line up the HEPA filters.

MEMBER SCHULTZ: That's what I expected. I just wanted to get the question answered. Thank you.

MS. STEINMAN: So on this slide provides a conceptual diagram of the main control room HVAC system. The red box on the right-hand side encloses the four 50 percent capacity air handling units. The box on the left-hand side denotes the two 100 percent capacity emergency filtration units which consist of the electrical heating coils, high efficiency filters, HEPA filters and charcoal absorbers.

The HEPA filter and the charcoal absorber are responsible for the radioactive materials. And the electrical heating coils are provided power from Class 1E power supplies in order to ensure that the relative humidity is maintained below 70 percent for the purpose of ensuring the efficiency of the charcoal absorbers.

The high efficiency filters are installed as both a prefilter and an after filter, whereas the prefilter is used to remove the larger airborne particulates from the air stream to prevent excessive

loading of the downstream HEPA filters. This diagram also shows the various isolation dampers associated with the system.

There are three open items associated with Section 6.4. RAI 559-4387, Question 06.04-11 is related to main control room flood protection. MHI has provided the detailed description of the leak tight doors and the stairs that are credited as part of the Chapter 19 analysis to prevent flooding of the main control room vestibules. This item is currently a confirmatory item pending the DCD changes associated with the RAI response.

RAI 927-6460, Question 06.04-16 is related to the air handling unit cooling coil condensation drain lines. And MHI has responded to this RAI providing the requested additional information and revised the DCD in accordance with this response.

And finally, RAI 955-6585, Question 06.04-17, is related to the protection of the operators from chiller refrigerant leaks and MHI has responded to this RAI indicating conformance with the ASHRAE requirements and updated the DCD to clarify this conformance. As a result, MHI believes that the technical issue in this RAI has been resolved and is simply pending staff review of the response.

CHAIRMAN STETKAR: I had one other question. In Section 6.4.1 of the DCD, there's a brief discussion about design features for buildup of carbon dioxide in the main control room. And as best as I can tell, the rationale is it's stated that the control envelope volume is approximately 140,000 cubic feet which exceeds 100,000 cubic feet. The air inside the control room envelope can support five persons for at least six days. Therefore, the CO2 buildup in the emergency isolation mode is not considered a limiting problem. In other words, it basically says that even if the control room is completely isolated, five people can sit in there and breathe for six days without having any adverse effects from CO2. Okay, I'll take that at face value. What do I know about people and CO2?

However, in response to the staff RAI about possible need to use the main control room if the technical support center is not available, and I don't know what that means, but because the technical support center is only powered for nonessential power, it might not be available under a number of conditions. There's a discussion that says well, we'll take some people from the technical support center and we'll put them in another location, but there's a statement that says plant management function would be transferred to the

main control room should the TSC become uninhabitable. While the ultimate details of this contingency would be part of a licensee's emergency plan or beyond the scope of the standard design, MHI estimates that in terms of manpower, the plant management function would consist of three senior licensee plant management personnel and five NRC personnel.

Now depending on how I count bodies, I can how account for somewhere between I'm guessing 11 and 13 people in the main control room if the TSC is not operable. Now the question becomes if the main control room is isolated or if it's in the pressurization mode where you're effectively relying on these normal exfiltration rates to circulate air, do we then have a concern about CO2 buildup? In other words, do I have confidence that either the 140,000 cubic feet of volume is enough to support -- I'm not quite sure about the body count, 11 to 13 people, or do I have confidence that I have enough fresh air intake given whatever assumption there is about normal exfiltration to provide enough air makeup to support that complement of people. There too, I'm not sure it can be answered today.

MR. HOTCHKISS: I'll give you a general response. Marc Hotchkiss again. I think for the isolation mode that's related to a toxic gas event or

smoke from some fire in the yard or something, so a consequent of that and having to evacuate TSE because you don't have power of the TSE is probably unlikely. But looking at the pressurization --

CHAIRMAN STETKAR: Yes, I'm actually a little more concerned about the pressurization mode because that would be an accident kind of condition.

MR. HOTCHKISS: Correct. And we provide -- the design provides up to 600 or actually 1200 cubic feet per minute, but 600 feet per minute of outside, as you said, depending on exfiltration.

CHAIRMAN STETKAR: I was going to say, depending on exfiltration.

MR. HOTCHKISS: You can always create a little more exfiltration if you needed to, but --

(Laughter.)

-- so there's a large volume of air. I'm not sure that that's been analyzed.

CHAIRMAN STETKAR: Okay.

MR. HOTCHKISS: I would say there are probably options to create more fresh air intake --

CHAIRMAN STETKAR: I've asked this question to other people on other designs in the past and everybody has said well, we have the makeup capacity, but getting the air out, fans don't do all that well

in that mode. You actually have to have a throughput.

MR. HOTCHKISS: Right.

CHAIRMAN STETKAR: And people tend to have not thought about getting the right amount of air out. So I wasn't quite sure. Because I don't have any information about the exfiltration. I only know that with a nominal 1200 SCFM makeup capacity and whatever you assume for exfiltration, you can maintain the pressure differential. But I mean that could be maintained with zero exfiltration.

MR. HOTCHKISS: And we would test the boundary to be relatively leak tight.

CHAIRMAN STETKAR: Yes.

MR. HOTCHKISS: So in the event there were breathing problems, I would imagine you would have to establish more exfiltration through a doorway or something like that. I suppose an analysis could be done assuming as I said, maybe 12 people or something.

CHAIRMAN STETKAR: I was just curious because it didn't seem that the staff had probed it at all. Okay. If you have anything or you thought about it, I'd appreciate it. Thanks.

MS. STEINMAN: Moving on to fission product removal and control systems. We just have a brief slide here that summarizes the various subsections of the DCD

6.5 fission product removal and control systems. Fission product removal systems confine fission products -- next slide. There we go.

Fission product removal systems confine fission products that are released from the reactor core and become airborne. The removal in the control systems are items that we have already talked about in this presentation. The main control room HVAC system which was just discussed in Section 6.4; the annulus emergency exhaust system, which was discussed as part of 6.3; containment spray, which was discussed as part of 6.2.2; and the containment vessel, which was described in terms of the construction aspects of that under Section 6.2.1.

There are no open items related to DCD Section 6.5.

This slide provides an overview of the different subsections for DCD Section 6.6 for in-service inspection of Class 2 and Class 3 components.

Next slide, please.

This section provides information on the ISI program for the ESF components to address the requirements that are outlined in 10 CFR 50.55a(g). This section includes pre-service and in-service examinations and system pressure tests.

DCD Section 3.2 identifies ASME Code

Section 3, Class 2 and 3 components as corresponding to quality Groups B and C components.

The initial ISI program incorporates the latest edition and addenda of the ASME Boiler Pressure Vessel Code approved by 10 CFR 50.55a(b) 12 months before the initial fuel loading.

Next slide, please.

Section 6.6 addresses the requirements for accessibility, examination techniques and procedures, and inspection intervals, all of which are addressed in accordance with the ASME Code Section XI.

The COL applicant is responsible for identifying the implementation milestones for the ASME Section XI ISI program for ASME Code Section 3, Class 2 and Class 3 systems, components, piping, and supports further requirements of 10 CFR 50.55.

And there are no open items associated with this section of the DCD either.

So we have come to the end of the Chapter 6 presentation this morning. Today's presentation covered the key features of the US-APWR engineered safety features including the containment, the ECCS, the habitability and fission product removal and control systems.

The US-APWR is designed to meet the

applicable codes, standards, and regulatory requirements for these systems.

Although there are 12 open items identified in the staff's safety evaluation, each of these items has either been closed since the SE was written, additional information has been submitted to the staff for their review in response to closure of the item or the item is simply waiting for confirmation of changes in the DCD that were previously committed in RAI responses.

As a result, we feel confident that there are no significant outstanding issues that cannot be adequately dealt with as part of the Phase 4 review. We acknowledge that there is some areas with continued work, but we believe that the defined closure path can be found.

CHAIRMAN STETKAR: That's good to hear. I'm glad you're on a path to closure. Thank you. Do the remaining members here have any further questions for MHI?

Ryan, I'll ask you because you're staring at me and you -- do you have anything to follow up, anything that we asked this morning?

MR. SPRENGEL: I have a number of actions. I don't know if you wanted to run through those or trust

me.

CHAIRMAN STETKAR: I always trust you.

(Laughter.)

You're much more organized than I am. So let's keep whatever you have on your list there. If you can get any feedback from anyone in the next 24 hours or so, you might be able to tick off some of those boxes.

MR. SPRENGEL: So one of them to tick off will be the question about the reduction of pressure accounting for DCD start time.

CHAIRMAN STETKAR: Yes.

MR. SPRENGEL: It is accounted for in the 180 seconds.

CHAIRMAN STETKAR: It is accounted for in that.

MR. SPRENGEL: Yes.

CHAIRMAN STETKAR: So that 130 seconds to get the fan up to speed is basically 100 seconds to get power to the fan, plus 30 seconds to run the fan up. Okay, great. Thanks. That answers that one.

MR. SPRENGEL: And anything else I think we'll follow up the beginning of the morning tomorrow.

CHAIRMAN STETKAR: That's fine, that's great. Good. And if MHI doesn't have anything else, we'll call the staff up.

(Pause.)

This says proprietary information on it, so I'm going to assume it's proprietary, so what we need to do is have MHI and the staff confirm that there isn't anyone in the room who is not authorized to see this and we need to close the phone.

MR. SHUKLA: The phone is only for the MHI people.

CHAIRMAN STETKAR: We just want to make sure that's the case. I had feedback from another meeting in a different month and indeed we thought there were only accepted people on the line and there weren't, so we need to be careful.

MR. SHUKLA: Because we have the same number.

CHAIRMAN STETKAR: Because we have the same number for people dialing in. So we'll just wait to make sure we've got the phones taken care of.

(Whereupon, the phone lines were terminated.)

MS. REYES: So I guess we're ready to start now?

CHAIRMAN STETKAR: As long as everybody here inside the room is happy, I'm happy.

(Whereupon, at 1:23 p.m., the meeting

adjourned into closed session, and resumed in open session at 2:59 p.m.)

CHAIRMAN STETKAR: Okay, we are back in session. In this session, we're going to cover Chapter 6 of the combined license application FSAR. And we'll start with Stephen Monarque from the staff.

MR. MONARQUE: Thank you, Chairman Stetkar. Good afternoon. I wanted to thank the committee members for giving us an opportunity to present Chapter 6, Safety Evaluation for the Comanche Peak Combined License Application.

As you're well aware, we've been here numerous times today in front of subcommittee and full committee and we're making progress as Phase 2 Safety Review.

And with that, Mr. Stetkar, I'd like to go ahead and turn it over to Luminant for their presentation. Afterwards, we'll do ours.

CHAIRMAN STETKAR: Okay. Thanks, Stephen. Don?

MR. WOODLAN: Yes, good afternoon. I'm Don Woodlan. I'm the manager of Nuclear Regulatory Affairs for Luminant and for the new build project. It's a pleasure to be here again today.

I'm going to turn it over to Todd Evans.

Todd is going to give the presentation. A lot of people for so few pages.

(Laughter.)

Go ahead, Todd.

MR. EVANS: Good afternoon. I'm Todd Evans with Luminant and I'll be presenting the Chapter 3 and 4 application related to -- or the Comanche Peak application related to Chapter 6.

We have several things to go through. An introductory slide which gives kind of an overview, a few pieces of information. One slide on license condition that's in the Safety Evaluation Report and then several slides on site-specific applications.

The FSAR uses incorporated by reference methodology. There are no departures from the US-APWR DCD. All COL items are addressed in the FSAR. There is one license condition which we'll cover in the next slide. And I'm happy to still report that there are no contentions before the ASLB. The ASLB is not in force at this time, so all things have been dispositioned at this point. And also for Chapter 6, there are no open items from the Safety Evaluation Report.

The license condition that we have deals with availability of program details for NRC inspections of the pre-service and in-service inspection programs.

Luminant has no problem and agrees with the license condition. There is a little bit of discussion we have to have regarding the schedule or the timing of providing the schedule for the availability of the programs for NRC inspection. This is no different from several other license conditions that we have in some other chapters. And so it's just a matter of working out -- you see in the bottom paragraph there the words in italics are kind of the differences that we need to work out and we'll be expecting to finalize that with the staff and don't expect any issues related to that.

CHAIRMAN STETKAR: We don't worry about those things.

MR. EVANS: Moving on to the site-specific aspects. As you probably noted, Section 6.0, 6.3, and 6.5 are completely incorporated by reference with no departures or supplements, so we won't talk about those. For the other parts of Chapter 6, the site-specific aspects are primarily COL items related to the implementation of the timing of the implementation of various programs. We'll go through each of those very briefly.

The first example that's in Section 6.1 which deals with the coatings program and it's simply an additional sentence that we commit to have a coatings

program and implement that prior to the procurement phase.

Section 6.2 on containment systems has a couple of additional programs that we are committed. First of all, is the containment cleanliness program. It meets NEI 04-07 guidelines and its associated NRC safety evaluation. Part of that is a latent debris surveys are to be conducted prior to startup and during refueling outages and that it have controls in place to ensure that RMI fiber insulation aluminum remain consistent with the design basis requirements. So those things that are required and agreed to and specified in the design cert. the program will ensure that those are maintained during the operating phase of the units.

MEMBER SCHULTZ: Todd, does that mean the inspections surveys will be done during each refueling outage?

MR. EVANS: The commitment that we -- the agreement that we have is every other refueling outage.

MR. WOODLAN: Which is what the NRC wrote in their safety evaluation. They felt that was adequate so we adopted that.

MEMBER SCHULTZ: And there's nothing associated with any connection to maintenance

activities? In other words, the major refueling outage maintenance activity were in place, I would presume by a matter of programmatic issues that that would be --

MR. EVANS: There is. I don't remember the exact words in the FSAR, but there also are some words that go with what you're saying if there's any major significant activities and also it could trigger the surveys to be done.

MR. WOODLAN: And even beyond the FSAR, we're basically adopting the same procedure we use on Units 1 and 2 and those exact words are in there. In the area where there is more activity gets more attention when you do the containment closeout.

MEMBER SCHULTZ: Good. Thank you.

MR. WOODLAN: In our foreign material exclusion programs and all that.

MEMBER BANERJEE: Where is the fiber insulation? You mentioned fiber insulation.

MR. EVANS: There are some quantities of fiber insulation in containment within the zones of influence, so there is some -- very small amounts, but there are some that could --

MEMBER BANERJEE: What location is that? Is it --

MR. EVANS: It would be insulation for

piping or it could be even -- it could be dirt or things that are brought into containment and maybe if the FME program is not adequate could be left behind.

MEMBER BANERJEE: But this is not latent, right, debris? This is actual insulation on some piping with the ZOI?

MR. EVANS: Yes.

MEMBER BANERJEE: Rather than outside. I wonder where it is.

MR. EVANS: John, do you know?

MR. WOODLAN: John Conly, do you know?

MR. CONLY: I am John Conly with Luminant. The fiber insulation would most likely be on valves, small equipment, but it is not in the ZOIs.

MEMBER BANERJEE: Yes, that's what I was asking. So it's outside the ZOI?

MR. WOODLAN: Yes.

MEMBER BANERJEE: And the aluminum, where is the aluminum?

MR. WOODLAN: Aluminum, where is there aluminum located inside containment?

MR. CONLY: I do not know.

MR. WOODLAN: Okay.

MEMBER BANERJEE: Where is the aluminum?

MR. SPRENGEL: I want to go back to fibrous

insulation. The design does not include fibrous insulation.

MEMBER BANERJEE: Right.

MR. SPRENGEL: So there is fibrous insulation in terms of testing to simulate the latent debris. And there are margins associated in the testing, and we'll, of course, go through that in detail and break down the different quantities that were used for the testing that was completed.

MEMBER BANERJEE: So the answer given to us that it's on small valves and things outside of the ZOI, so you don't even have anything outside the ZOI?

MR. SPRENGEL: My understanding right now is we've removed all fibrous insulation inside containment.

MEMBER BANERJEE: All fibrous insulation.

MR. SPRENGEL: Now that's not to say that it wasn't included for testing to allow for margins, but --

MEMBER BANERJEE: But that's different, yes.

CHAIRMAN STETKAR: That's important. I mean we'll obviously revisit this on October 1st, but the last I had understood was that there was no fibrous insulation in the zone of influence anywhere, but there

could be and was fibrous insulation in other locations because I think we asked it one time, what are those other locations.

MEMBER BANERJEE: Maybe that's changed since that time.

CHAIRMAN STETKAR: That may have changed. We had heard things like main feedwater lines and main steam lines and things like that.

MEMBER BANERJEE: We'll clarify this in the GSI-191. Of course, it's very important. And also, of course, where the aluminum is, how much can get submerged. I know that is very hard for you to predict that number, the aluminum particularly, but some sort of determination of that would be helpful.

MR. MONARQUE: Don, this is Steve Monarque. Can MHI give you an answer on aluminum?

MR. WOODLAN: I think they're looking right now.

MEMBER BANERJEE: We can hold this.

CHAIRMAN STETKAR: I'm not going to speculate --

MEMBER BANERJEE: This is something which we can take up on October 1st. It's not mission critical to answer it right now.

MR. WOODLAN: I think what is pertinent

with respect to this bullet is that whether there is in the original design any fiber insulation or aluminum, there is a limitation on how much we can have going forward to support the testing and the design of the sumps and we are obligated periodically to confirm that we are within those limitations.

MEMBER BANERJEE: Yes, whatever those are set at.

MR. WOODLAN: Whatever they are set at. And those are in the DCD, those limitations. And we are adopting those.

CHAIRMAN STETKAR: This essentially is a commitment that you're not going to leave a bunch of aluminum step ladders located everywhere.

MR. WOODLAN: Or add a whole bunch of lagging some place. Absolutely.

CHAIRMAN STETKAR: Okay.

MR. EVANS: And similarly, we will have a containment integrated leak rate test program, defined by Tech Spec. 5.5.16 and it will be implemented prior to fuel load.

Moving on to Section 6.4, habitability systems, the first slide talks about dose for main control room operators. And this is simply because of the DCD is for a single-unit site, and at Comanche Peak

we have a multiple-unit site, then this is a site-specific aspect that we cover that basically says that the dose to main control room operators in adjacent as well as from existing operating units is bounded by the dose of the operators from the affected unit. So that analysis that's done as part of the DCD bounds analysis would be from adjacent units.

Continuing on with habitability systems, all postulated releases of toxic chemicals resulted in concentrations below the IDLH which is the imminent danger to life and health. There are no procedure requirements required for operators to take protective action in response to chemical releases. Instrumentation is not required to detect and automatically isolate the control room envelope from chemical releases, but if necessary operators always have the decision capability to isolate the main control room manually as was described in the DCD presentation.

CHAIRMAN STETKAR: I have a few questions about this one. First of all, Section 2.2.3.1.3 of the FSAR identifies most limiting toxic gas release as a chlorine tanker truck accident on OAFM 56. And that's the most limiting one at least that was identified in that part of the FSAR. And its frequency was evaluated to be greater than 10^{-6} per year so therefore

you have to do something to protect against that.

Now one thing that -- I have several questions, but the top bullet on here up at the top says "all postulated releases of toxic chemicals resulted in concentrations below IDLH." In the SER, this again is perhaps a little bit of deviation, but in the SER in Section 6.4.4 of the SER makes reference to RAI 6158 Question 06.04-15, I'm going to rattle these off so people have them in the record.

It says "the plot indicated that the time available for control room operator to detect a chlorine release at the odor threshold, .08 ppm, and then take protective measures before the IDLH of a main control room concentration of 10 ppm is reached is always over 12 minutes. This is well over the two minutes considered by Regulatory Guide 1.78 as adequate time before the IDLH of the main control room concentration of 10 ppm is reached."

That to me indicates that -- I don't have this -- I haven't look at the RAI response, but that to me indicates that an IDLH of 10 ppm can be achieved. It says it's reached at more than 12 minutes.

MEMBER BANERJEE: Within the control room.

CHAIRMAN STETKAR: Right. That's all we care about here. It doesn't say that an IDHL is never

reached which is your top bullet there. So I'm curious about whether you can actually reach that concentration, that 10 ppm concentration.

MR. EVANS: I think that's a good point that we might want to take a look at it and have some dialogue with the staff on. The RAI response and the curve that it's referring to, it doesn't go out for infinity, but it goes out a good little ways and it doesn't reach 10.

CHAIRMAN STETKAR: It does not reach 10.

MR. EVANS: It's getting kind of asymptotic and --

CHAIRMAN STETKAR: I'd be curious. I'm actually more interested in another part of this discussion, but that first bullet caught my attention because the RAI, what's written in the SER seems to imply that sometime after 12 minutes, I don't know how much after, you're saying it might be infinitely longer than 12 minutes, you would reach that 10 ppm. And they're just using in the SER, they're just saying well, 12 versus 2 minutes because the Reg. Guide says that I have two minutes to avoid dying or something like that.

MEMBER SCHULTZ: This could be addressing postulated releases and discussion about the operator identifying and being able -- having more than ten minutes to respond to an unpostulated release might be

the other way to look at the possibilities.

CHAIRMAN STETKAR: Yes, but one of the postulated releases is this tanker truck accident.

MEMBER SCHULTZ: No, I understand.

CHAIRMAN STETKAR: And they couldn't make that go away.

MR. WOODLAN: I think it has to do more with the third bullet up there in that the Regulatory Guide allows operator action if he can sense the event.

CHAIRMAN STETKAR: Right.

MR. WOODLAN: And the point is that he can use that to manually isolate and therefore you will not reach the IDLH in the control room. It could under a worse condition and ignoring the conservatisms, you reach the value.

MEMBER SCHULTZ: Make the top follow the conclusion.

CHAIRMAN STETKAR: Before I saw that top bullet, I'm actually more concerned with the second line of reasoning. You're not proposing to install any toxic gas monitors in the control room ventilation intake, is that correct?

MR. EVANS: That's correct.

CHAIRMAN STETKAR: There's no instrumentation. So I'm an operator sitting in the

control room, the first indication that I have of a toxic gas release is that I start to get really uncomfortable. My eyes start to water and I start to detect --

MR. EVANS: There's another line of defense practically before that. It's very possible that somebody outside the control room could detect or know or is aware of the tanker truck accident and our procedures would have them -- those kind of things would inform the control room --

CHAIRMAN STETKAR: Let me read something to you from Section 6.4.4.2 of the FSAR. It says "For Class F stability and worst case sensitivity analysis conditions of an intake height of zero meters, solar radiation at 1150 watts per meter squared, a wind speed of 6 meters per second, air and ground temperature of 115 degrees Fahrenheit, and a cloud cover of zero tenths, the concentration in the MCR" -- this is from that tanker truck accident -- "reaches human detection threshold for chlorine, .08 ppm at approximately 0.25 minutes, 15 seconds, and reaches the maximum concentration, 8 ppm, in approximately 16 minutes."

So under the worst possible conditions they aren't going to have any forewarning. Now granted under not the worst possible conditions they might have forewarning.

My whole point here is we are now then relying on the operators to take manual action based on their discomfort and the Reg. Guide, the wonderful Reg. Guide written by people who have never operated a power plant wearing self-contained breathing apparatus says well, they still have two minutes to put on self-contained breather apparatus and operate the power plant, even if they don't isolate the intake. Right? I'll ask the staff about this later.

So my question is why don't you at least put an alarm, a detector and an alarm in the intake? If you're going to rely on the operators manually isolating the intake which is what you're relying on, with the only indication being their own physical discomfort?

MR. WOODLAN: Well, several things. First of all, you read the series of conditions it takes to actually get to that. It takes a series of worst case -- maybe not worst case, but very adverse case to get that.

CHAIRMAN STETKAR: I mean that's the shortest time that you evaluate it. There are multiple scenarios.

MR. WOODLAN: I think Todd started to mention this. In high probability, the operator

sensing the smell is not going to be his first identification except maybe in those very rapid cases. Between other people that are outside the building, especially the guard force, who are trained to alert the control room if anything abnormal occurs, they're probably going to smell it and notice it well ahead of time if they don't even see the accident actually occur and notify the control room that the accident has occurred. So there are paths which are much more likely that are going to notify the control room to say there's a potential event here that could affect their environment.

MEMBER BANERJEE: How far is this from the control room?

MR. WOODLAN: One point 4, 1.5 miles to the highway, to the control room.

MEMBER BANERJEE: Pascal F is clearly not that unusual unless you have a very unusual site.

MR. WOODLAN: Got you.

MEMBER BANERJEE: So basically is this down hill or is it up hill from the --

MR. WOODLAN: It's very flat.

(Laughter.)

MEMBER BANERJEE: If it's up hill, of course, it helps you a lot. Chlorine doesn't easily

go up hill.

MR. WOODLAN: Fairly flat, maybe slightly down hill.

MEMBER BANERJEE: The wind speed is a little high for Pascal F, given six meters per second, but not unusual. It could happen. It's not that difficult to get those conditions.

MR. EVANS: The combination of the conditions, I think --

MEMBER BANERJEE: But Pascal F is going to give you a relatively low rate of speed. It's usually going to be sort of a partly covered sky, so it's not that difficult to hit those conditions. Actually, you can say the wind coming in your direction from there, that has to be taken into account.

Plus, I assume that this calculation asking the staff was done with a dense gas dispersion model, right?

CHAIRMAN STETKAR: That is something we can ask the staff.

MEMBER BANERJEE: Are you going to speak about this? Because clearly that has a large effect on the dispersion with chlorine being such a dense gas. So this is, of course, very well understood in the chemical industry, but I don't know if it is in the

nuclear industry. So dense gas disposal is very, very low under these conditions.

The turbulence is rather low and it hugs the ground, so there's a whole set of different codes you have to use, calculations. I don't know what you guys use, but you did this work. It's not that unusual is what I'm saying, these conditions. And a mile for a tanker car is not that far. You know, they had to evacuate Mississauga in Toronto, one of the suburbs because a chlorine tanker derailed. So it happens. It's quite --

MR. WOODLAN: So John, I think the answer to your question, because it is a fairly low probability event, because there are multiple scenarios that the operator would be alerted. He does have the tools necessary to mitigate the event and it meets the regulatory guidance. I think the combination of items is why we chose not to install the monitor.

MEMBER BANERJEE: Would it be a bad idea just to put an alarm or something? It sounds not that difficult.

MR. EVANS: Sometimes those alarms can give you a lot of spurious alarms as well. And control room operators don't like to be distracted with spurious alarms. You've got to take that into consideration as

well.

CHAIRMAN STETKAR: I would rather be distracted by a spurious alarm every now and then than to breathe chlorine.

MR. EVANS: All right. I hear what you're saying.

CHAIRMAN STETKAR: Okay. I don't necessarily have to agree with you, but I hear what you're saying.

MEMBER BANERJEE: The chlorine tanker is a mile and a half from the plant?

MR. WOODLAN: I don't think it's a common event, but it's always a possibility.

CHAIRMAN STETKAR: It's a road. It's not like gas lines that run around the plant.

MEMBER BLEY: There are not a lot of alternatives, I suspect.

MR. EVANS: Okay, moving along to Section 6.6.

MR. WOODLAN: John, were there more questions on that part?

CHAIRMAN STETKAR: That's basically it. I'm going to ask the staff a bunch of things.

MR. WOODLAN: Okay. Go ahead, John.

MR. EVANS: Again, we have some programs

that are being implemented by Luminant as site-specific items. And the pre-service inspection and the in-service inspection programs will be implemented prior to fuel load. And then also the augmented in-service inspection program will be implemented prior to fuel load. And that concludes our presentation, unless you want to go through the acronyms which I don't intend to.

CHAIRMAN STETKAR: I'm just writing some notes here. Any of the members have any other questions for Luminant? If not, thank you. Appreciate it.

(Pause.)

MR. MONARQUE: Can you hear me okay? My name is Stephen Monarque. I'm the lead project manager for the review of the combined license application and today we're going to discuss Comanche Peak Nuclear Power Plant Units 3 and 4, Safety Evaluation Chapter 6, Engineered Safety Features.

These are the -- introduces Ruth Reyes as the Project Manager and myself. The next page is the Technical Review Team with David Nold and Clinton Ashley among others. There's no -- I'm going to go back. There were no open items on this which is why Ruth didn't have any open items or identify any issues to bring to the attention of the subcommittee. But having said that,

we await your questions on Section 6.4. With that, we conclude our presentation.

CHAIRMAN STETKAR: I noticed it was pretty informative. You heard my questioning of the applicant. I guess I'll now turn the attention to the staff. What I'd like to understand is why the staff feels that the site-specific design provides adequate protection for the control room operators, given the fact that it does not include either automatic closure on detection of toxic gas or any instrumentation to alert the operators to a toxic gas intake into the ventilation. You're relying strictly on the discretion of the operating team based on their sensory ability to detect the intake of some sort of toxic gas. The example is chlorine, but in principle any toxic gas.

MR. NOLD: My name is David Nold. Earlier, you pulled a passage from the NCR that talked about the limits or the concentration of the limit control -- it sounds like it was actually going to surpass. You could interpret it would be greater than 10 parts per million. I believe I pulled that passage directly from an RAI response and from all the review that I did with HABIT and ALOHA, I could never get it to exceed 10 points per million.

CHAIRMAN STETKAR: You could not?

MR. NOLD: I could not.

CHAIRMAN STETKAR: Again, I'm just quoting, this is a direct quote from the SER and it does refer to that RAI response. The only thing it says is that "before the IDLH of a main control room concentration of 10 ppm is reached, is always over 12 minutes." Now what I don't know is I don't have those curves. I don't have the analyses.

And then it goes on to say "this is well over the two minutes required by Reg. Guide 1.78" for the operators to do something manually. So it's argued that 12 minutes versus 10 minutes is a margin.

The implication from reading this is it might go over. Now Luminant essentially says that and I think what I hear you saying is that not only is it over 12 minutes, it's infinitely over 12 minutes, that you never quite reach 10 ppm which is fine. I'll give you that. So the operators if they stand there, aren't going to die.

On the other hand, the operators at concentrations well below that 10 ppm, in fact, what does it say, .08 ppm is where they start to detect things, chlorine is pretty nasty. I used to work with chlorine. It isn't the kind of thing that you like to breathe. They're going to start feeling pretty doggone

uncomfortable at well below IDLH where they die. And so I'm actually less concerned about whether or not you eventually could theoretically reach the lethal concentration in the control room.

I'm more concerned about essentially the fact that we're relying on the discretion of the control room operators to detect the chlorine or any other toxic substance through their own senses and then decide to take the appropriate action.

Now as far as the Reg. Guide says well, they're allowed two minutes to put on self-contained breathing apparatus. I don't know if you've ever worn self-contained breathing apparatus. It's not all that comfortable or useful to try to operate a nuclear power plant wearing that stuff. So that's certainly something that I don't particularly like them to do.

In this case, they could isolate the control room ventilation intake manually. You know, after they determine that indeed that's required. What I'm asking you is why is the staff comfortable with the fact that those -- that that combination of conditions provides adequate protection?

When I say adequate protection, I don't mean in terms of death. I mean in terms of the operator's ability to reliably continue operation of the nuclear

power plant.

MR. NOLD: I believe the way we -- the amount eventually was done with respect to using a lower until it became neutrally buoyant. In other words, it behaves like heavy gas initially and up to like one percent the neutrally buoyant behavior takes over. And I think that just -- when we took that approach and we also used as a habit from that new virtual source location, we came up with a worst case situation that did not exceed ten parts per million.

CHAIRMAN STETKAR: I don't care that it doesn't exceed ten parts per million. I don't want them to die. I just don't want them to be operating under conditions where they're really uncomfortable. I want those operators to be nice and happy and comfortable and breathing good air, not breathe good air from a bottle. So I'm -- as I said, I'm not concerned particularly about that ten ppm because it's just Luminant's first bullet on the slide kind of caught me by surprise a bit.

I'm more concerned about pick a number, 1 ppm, well above, 12 times -- I'm sorry 120 times, is that right? Twelve times the concentration of first detection, one ppm. I think the operators would be really uncomfortable.

MEMBER BLEY: Right and uncomfortable isn't just uncomfortable, it means they're probably not as effective doing their job. They may not be making good decisions, that sort of thing.

CHAIRMAN STETKAR: So I'm assuming that your analyses show that the concentration could exceed one ppm?

MR. NOLD: Yes, yes.

CHAIRMAN STETKAR: So now my question is well, if the concentration can exceed one ppm, we're relying on the operators to detect that by smell, by I don't know, watering eyes, whatever, however they detect it. And decide to take the right actions which I would presume would be isolating the ventilation intake within enough time before they get really uncomfortable. And we're not relying on an alarm to say more sensitivity that we detect something to alert them to the fact that this isn't something impending --

MEMBER BLEY: Let me ask something that would help me in this area a little

CHAIRMAN STETKAR: Yes.

MEMBER BLEY: You quoted a bunch of stuff earlier. What's the concentration at which we can begin to sniff this stuff?

CHAIRMAN STETKAR: .08 ppm.

MEMBER BLEY: .08 ppm. What kind of instrumentation is available and what level can you start to have reliable instrumentation for chlorine?

MR. NOLD: I don't have the answer to that.

MEMBER BLEY: Any of the experts on design and control habitability know about that?

MR. MONARQUE: Don is going to take a shot at it.

MR. WOODLAN: I don't know if you want to go into this or not. I do have the curve that we ran in how the chlorine values go up based on wind speed that I could probably hook up if you'd like to see that. In addition, our response to this question which is quoted in the SER talks about the impacts of chlorine at various levels and the -- let me find this.

MEMBER BLEY: What is the RAI?

CHAIRMAN STETKAR: The RAI is the 6158, Question -- 6158, that's all one number. Question 06.04 -- hold on a second.

MR. WOODLAN: Is it 15?

CHAIRMAN STETKAR: I'm reading 15 here, but I'm not sure whether it's 15 or 5.

MR. NOLD: It's down to two. That's close

enough for me.

MR. WOODLAN: This is Don Woodlan. It's 06.04-15.

MEMBER BLEY: I do want to look at this stuff Don just mentioned.

MR. WOODLAN: Just to enhance the discussion a little bit about chlorine, in our response, let me read you some words from it, "The IDHL limit for chlorine is 10 ppm and is inherently conservative since it provides significant margin for the safety of the operators. For example, the NIOSH, National Institute of Occupational Safety Health, documentation for immediate dangers to life or health concentrations for chlorine indicate the original IDHL of 30 ppm was based on" and this is in quotes "exposure to 30 ppm would cause intense coughing fits and exposure to 40 to 50 ppm for 30 to 60 minutes or more may cause serious damage." So that just maybe helps.

CHAIRMAN STETKAR: It helps.

MR. WOODLAN: In understanding the impacts of chlorine and our curves when we ran -- the computer program kicks off the software, it kicks off after so long. We never -- just like the NRC staff said, we never reached 10 ppm in our runnings, but we got as high as 9 ppm and it was still going up although gradually as

these curves do, they were tailing off. We could not say it never reached 10 ppm, but our runs never did.

MEMBER BANERJEE: And what were you using for this calculation? How did you do the calculation?

MR. WOODLAN: I'm sorry, I couldn't hear the question.

MEMBER BANERJEE: How did you do the calculation?

MR. WOODLAN: The actual final run?

MEMBER BANERJEE: The run, any run.

MR. WOODLAN: It was based on wind speed and was it -- which code finally gave us the --

MEMBER BANERJEE: What was the methodology for doing the calculation?

MR. EVANS: This is Todd Evans. We used a combination of code referred to as ALOHA and HABIT. Offhand, I don't remember.

MEMBER BANERJEE: HAVIT?

MR. EVANS: HABIT, H-A-B-I-T.

MEMBER BANERJEE: HABIT.

CHAIRMAN STETKAR: HABIT, H-A-B-I-T.

MR. EVANS: The reason for the two codes was to be able to answer some questions that the staff had regarding the heavy gas and being able to model the dispersion of the chlorine gas over the distance, so

one model took the analysis for a certain distance and then the other model was able to take it the rest of the distance including the height changes for the main control room intake.

MEMBER BANERJEE: So I assume ALOHA is your heavy gas dispersion code, right? And HABIT takes the concentration field outside the control room and changes it to what will happen inside, right? I assume. Is that true?

MR. EVANS: Yes.

MEMBER BANERJEE: Okay. And are those codes both approved by the NRC or accepted?

MR. NOLD: Just the HABIT code is in the Reg. Guide right now.

MEMBER BANERJEE: Okay. And I seem to remember vaguely in the past that we had some questions about this.

MEMBER BLEY: In fact, you dug into one of the codes that you said. I didn't think it was HABIT though.

MEMBER BANERJEE: I'm trying to remember. There was some issues we had.

MEMBER BLEY: It didn't model the heavy gas in the right situations, but I don't remember about HABIT.

MEMBER BANERJEE: We'll have to go back in history. There was another plant --

MEMBER BLEY: It was within a year or two.

MEMBER BANERJEE: Now that we know what the codes are, we can dig back and see because there was some issues. Maybe they were false and maybe they were not. But we need to go back and look at that.

MR. KELLENBERGER: This is Nick Kellenberger at MNES. The genesis of the question when this was asked was specifically ACRS questions on HABIT code, not modeling, but heavy gas. And the alternative was to use ALOHA while it still acted as a heavy gas. And once it transitioned to a neutrally buoyant gas that you could model and have it correctly switch it over and model the rest of it in HABIT.

MEMBER BLEY: But ALOHA is not one you guys looked at?

MR. NOLD: We did. We did use ALOHA, just as was explained for the first half mile of the accident and we took the HABIT code.

MEMBER BLEY: But it's not in your guidance.

MR. NOLD: It's not in our guidance.

MEMBER BLEY: Did you review the code itself to be comfortable that it's doing what it's

supposed to do?

MR. NOLD: Yes.

MEMBER BLEY: The one you're trying to remember, it was a release down below and it had to go up a hill. And I think they used habit while it was a heavy gas and trapped in this area where it didn't model things right.

MEMBER BANERJEE: Was that with regard to summer? I'm trying to remember, going up hill?

MEMBER BLEY: I'm going to have to go look it up.

MEMBER BANERJEE: Anyway --

CHAIRMAN STETKAR: Be a little careful.

MEMBER BANERJEE: We need to look this up, but perhaps what Dennis is saying is the real situation that we were concerned because one was using a neutral buoyancy code to go uphill and maybe that's not the case here.

So ALOHA is what? Is it an industry code for a heavy gas dispersion?

MR. KELLENBERGER: ALOHA was developed by National Oceanic and Atmospheric Administration.

MEMBER BANERJEE: Okay, for heavy gas dispersion. Is that what they did? Was it specifically for heavy gas?

MR. McKIRGAN: Dr. Banerjee, this is John McKirgan for the staff, if I could shed a little light and maybe refresh your memory.

MEMBER BANERJEE: Okay.

MR. McKIRGAN: Certainly, it was indeed summer was the application you were thinking of. In that case, the staff did use HABIT. The licensee basis there was ALOHA and that was a long discussion we had, both with the Committee and/or the mandatory hearing, so there was a rich history in the transcripts that you could refresh yourself on. But that was the issue.

Certainly, the staff has endorsed HABIT. We also commonly use ALOHA. It is a heavy gas model that the staff has looked -- it's subject to continued reviewed by the staff. We're looking at it actively now. We have user need with the Office of Research that's continuing to look at that. In this case, the applicants used ALOHA as they've described to try to capture the heavy gas portion of the release.

MEMBER BANERJEE: Thanks. That's helpful. Because it's also helpful that you're continuing to look at ALOHA. Okay. I think you've answered my question.

MEMBER SCHULTZ: We talk a lot about the calculational methodologies and the results that are

derived from the likelihoods and probabilities, but I wanted to go back to Dennis' comment. It seems that it would be very valuable to know what the availability and reliability is of a toxic gas monitoring system that could be of help to the operating staff.

What we heard from the designer this morning really impressed me with respect to the facility that has been designed to protect the control room operators from toxic gas and smoke and radioactivity in the event of a severe accident. It's a very robust control room ventilation system design. And this is a missing piece that John has brought up that talks of gas monitoring in the event of something happening, whatever that something is.

I think it would be certainly worthwhile for the design team to look at availability of a toxic gas monitor that would be reliable and just determine whether it is something that might be added to the design to take care of this issue.

MR. MONARQUE: We will take that under advisement for consideration.

MEMBER SCHULTZ: Thank you.

CHAIRMAN STETKAR: Do any of the members have any other questions for the staff? If not, --

MR. MONARQUE: I think we have some action

items regarding our presentation. You wanted the amount of aluminum in the containment. That was something MHI --

MEMBER BANERJEE: Where it was. That can be deferred to the GSI meeting. That's only a week and a half away.

MR. MONARQUE: And also we need to get back to you regarding availability/reliability of monitoring of toxic gas.

CHAIRMAN STETKAR: It is essentially what's the state of the practice or state of whatever you want to call it. What can you go out and buy in terms of something -- the sensitivity of something.

MEMBER BLEY: One of the reasons I asked that I was helping a petrochemical place and for a lot of things they had the human nose was a couple orders of magnitude better than any instrument you could buy. They actually employed the neighbors as helping staff.

CHAIRMAN STETKAR: You hear about -- I don't know anything about chemicals. I know what people are proposing so-called incipient detectors for smoke, and they claim that those are much, much better than the human nose. But I don't know about the chemical issue.

Well, if there are no other questions for

the staff, thank you very much.

What I'd like to do now is a couple of administrative things. First of all, are there any members of the public or anyone in the room who would like to make a comment on anything that's been covered today? If not, what I'd like to then do is open up the bridge line, Girija, and see if there's anyone out there listening in who would like to make a comment.

It always takes a couple of minutes to do this.

(Pause.)

CHAIRMAN STETKAR: We will open up the line as soon as Theron gets back so that we can do that. In the interim, as we always do, I'd like to go around the table and see if any of the members have any final closing comments. And I'll start with the good Dr. Banerjee?

MEMBER BANERJEE: I think whatever comments I had I tended to make during the discussion we had. There's nothing that leaps out needing special attention to me at the moment, which we won't handle at a later time. That's really the issue.

CHAIRMAN STETKAR: Dennis?

MEMBER BLEY: Nothing.

CHAIRMAN STETKAR: Steve?

MEMBER SCHULTZ: Nothing more.

CHAIRMAN STETKAR: Mike?

MEMBER RYAN: Nothing more, thank you.

CHAIRMAN STETKAR: Charlie? Well, I don't have anything more, so before --

MEMBER BROWN: On the 11 vice 20 igniters, did that get discussed? I had to leave.

CHAIRMAN STETKAR: No.

MEMBER BROWN: Okay, that's fine.

CHAIRMAN STETKAR: There is an RAI response and we do have the RAI on our CD.

MEMBER BANERJEE: I've looked at it once. I'll look at it tonight.

CHAIRMAN STETKAR: The RAI is on our CD and Charlie, for your reference I think that's 871-6121, Rev. 0. 871-6121. And it's on the CD that we got.

MEMBER BROWN: I think I've got that.

MEMBER BANERJEE: The only issue that could be that there's a sketch showing where the igniters are, but I'm not sure -- there are a couple of sketches that they actually show the elevation and the location and we might need that information.

MEMBER BLEY: Did we ever ask today what -- if we were right, that there were no igniters in the dome?

MEMBER BANERJEE: Well, at least the sketch indicates there doesn't seem to be, but we don't know that.

MEMBER BLEY: I thought I'd raise that since they're still here.

CHAIRMAN STETKAR: Dr. Bley, do you have a question?

MEMBER BLEY: Actually, I do.

(Laughter.)

CHAIRMAN STETKAR: Could you ask that question now?

MEMBER BANERJEE: If you look at this, Dennis, it doesn't look like it has.

MEMBER BLEY: I know, but it's not the world's best engineering drawing copy.

MR. SPRENGEL: The question about the 11 I think we pointed to the RAI for evaluation and we'll follow up on that. The basic answer was that it was most likely locations for beyond design basis event.

And so now the --

MEMBER BLEY: We looked at the RAI and it didn't look like you have any igniters in the dome.

MEMBER BANERJEE: The sketch didn't indicate that.

CHAIRMAN STETKAR: So I guess the basic

question is are there any hydrogen igniters at the top of the containment dome?

MEMBER BLEY: And if not, why is that reasonable?

CHAIRMAN STETKAR: If you don't know, perhaps we could get that answer tomorrow morning because it sounds like a statement of fact that should be pretty easy to find.

MEMBER BANERJEE: In more general terms the sketch is indicative of where the igniters are. Really, we don't have the elevations and a little bit more detail would be helpful. So in the RAI page 2.11.52 you show the location, but it's not clear exactly where these are.

And there is another sketch which shows it relative to the take-off, which is 6.2383 and it indicates, at least in the sketch, that all the igniters are below the level of the draw-off for the hydrogen monitor and radiation monitoring system. It's all sketches, so it's not clear which.

CHAIRMAN STETKAR: We have that. I'm still waiting.

MEMBER BLEY: We can just ask them to send an email or something.

CHAIRMAN STETKAR: Well, no. You know, in

fairness to anyone who is out there.

MEMBER BANERJEE: John, related to this tomorrow, we need to go through this RAI carefully.

CHAIRMAN STETKAR: Sure. For the purposes of this afternoon, I'm still waiting to see if I can get the bridge line opened up in case there is anyone listening in who might not be available tomorrow who might want to ask -- have comments or something. We can at least give them that opportunity. I'm not going to close the meeting until I can get that done.

MEMBER BLEY: It could be a sparse table.

CHAIRMAN STETKAR: It could be a sparse table. That's okay.

MS. REYES: John, Ruth Reyes, just for logistics I'm trying to engage the reviewer for the RAI related to igniters. Do you want to have this discussion tomorrow morning, correct?

CHAIRMAN STETKAR: Yes, because of other constraints, as -- I know we're -- on paper, the agenda shows us going all day.

MS. REYES: Yes.

CHAIRMAN STETKAR: There are some other meetings going on tomorrow afternoon that -- members have conflicts in. So as much as we can finish in the morning, I'd like to do that. And typically, what we

try to do just to maintain kind of continuity of thought, perhaps we should address that first thing in the morning before we get into the accumulator. So for logistics, I guess have them available.

MEMBER BANERJEE: There's also the ERIN report which I brought.

CHAIRMAN STETKAR: E-R-I. Not ERIN.

MEMBER BANERJEE: Which is on hydrogen mixing things. The question is related to that.

CHAIRMAN STETKAR: Hearing the popping and noise -- if there's anyone out there, just do us a favor, if you're listening in and say something so that we can confirm that the bridge is indeed open in this direction? Anyone? Not hearing any responses, I'm assuming that everyone has dropped off the line.

With that, I'd like to again thank the staff, thank MHI, MNES, Luminant, everyone for a very useful day. We got done early and we are adjourned.

(Whereupon, at 4:02 p.m., the meeting in the above-entitled matter was concluded.)

Official Transcript of Proceedings

NUCLEAR REGULATORY COMMISSION

Title: Advisory Committee on Reactor Safeguards
US-APWR Subcommittee - Open Session

Docket Number: N/A

Location: Rockville, Maryland

Date: Wednesday, September 18, 2013

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

+ + + + +

US-APWR SUBCOMMITTEE

+ + + + +

WEDNESDAY

SEPTEMBER 18, 2013

+ + + + +

ROCKVILLE, MARYLAND

+ + + + +

The Subcommittee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B1, 11545 Rockville Pike, at 8:30 a.m., JOHN W. STETKAR, Chairman, presiding.

COMMITTEE MEMBERS:

JOHN W. STETKAR, Chairman

SANJOY BANERJEE, Member

DENNIS C. BLEY, Member

CHARLES H. BROWN, JR. Member

JOY REMPE, Member

MICHAEL T. RYAN, Member

STEPHEN P. SCHULTZ, Member

DESIGNATED FEDERAL OFFICIAL:

GIRIJA SHUKLA

P R O C E E D I N G S

(8:30 a.m.)

CHAIRMAN STETKAR: The meeting will now come to order. This is the second day of the subcommittee meeting for the US APWR. I am John Stetkar, Chairman of the subcommittee meeting.

Members in attendance today are Sanjoy Banergee, Dennis Bley, Steve Schultz, Mike Ryan, Charlie Brown, and Joy Rempe. And Girija Shukla is our designated federal official.

I won't read through all of the caveats and restrictions that I described yesterday apply. Please turn off your cell phones. If you have any comments, please come up to the microphones, speak with sufficient clarity and volume.

We will open today's meeting in open session because, as I understand it, MHI, and I am not sure whether the staff have some responses to items that came up yesterday that can be discussed in open session.

And then we will close the meeting. I understand there are some responses are proprietary.

We will discuss those responses and then we will proceed with the topic of the advanced accumulator. So that is the way we will organize it.

And with that, I don't know if NRC Staff has anything that they would like to say as an introduction. If not, Ryan, or Rebecca, or someone from MHI will hit the ones that we can speak about in open session.

MR. SPRENGEL: Okay, good morning again. As already mentioned, we have got a couple follow ups that we would like to go through and some additional information I think to hopefully resolve any times from yesterday. But at a minimum, it will add to our discussion for any future follow-up.

There is a number of other times that we didn't rush into any responses today and we will follow this up with a letter in typical fashion.

So I am going to go ahead and turn it over to our first area.

MR. GEORGE: I am Tom George from Zachry Nuclear Engineering, a consultant to MHI.

There was some discussion yesterday about various GOTHIC models that were used for different applications for this licensing application. And so

we put together a table that kind of summarizes these models. On the left there, we talk about the five different models that were mentioned yesterday. The first one for containment heat pressure temperature; the next one for minimum containment pressure, sub-compartment pressure, EQ and hydrogen mixing.

The first three are the topics for Chapter 6 of the DCD. The last two are covered in other sections of the DCD but there was some debated discussion about those.

So this table describes first of all the references for supporting documents, some general idea of what the noting is for each one of these things and the assumptions, basic assumptions. And these assumptions are consistent with reg guides and previously accepted methodology to provide a conservative analysis for each one of these.

So I don't know if we need to go through the details of all those things right now but they are there for your review and for discussion purposes.

We go to the next slide.

MEMBER BANERJEE: Just before you leave, for the hydrogen mixing I was reading a very interesting report here by ERI. And they mentioned some work that

you would have done. I don't know if this was your consulting company or MHI, which seemed to have a higher utilization. I'm just looking for the numbers.

MR. GEORGE: Yes, I think actually there was an error in this slide. The last one should say 6 x 5 x 5, a little bit higher resolution in the Z direction.

MEMBER BANERJEE: Let me just try to find this. Why don't you continue while I look for it? Because apparently there was a fairly fine nodalized run done using GOTHIC and it showed certain things. One was that the containment was fairly well mixed when you have the containment sprays. But they tried to nodalize around the jets and plumes. And I don't think you were successful.

So this ERI model does sort of a hand model of the jet dispersion, based on some correlation from Liszt's book.

So maybe while you go on I will find this allusion. It was in response to an RAI, evidently. All this has become history now. It is there somewhere.

MR. GEORGE: I am not familiar with that particular report but I will say that the noding here that is for this, even for the dome, is really not

sufficient to get the details of a jet or a plume. And you would need much finer noding to get those details.

MEMBER BANERJEE: They tried to. I think there was a study. I will come to it but keep going.

MR. GEORGE: Okay. If we go to the next slide then, it is kind of a continuation of this first slide. Again, list on the left side there of the various applications using GOTHIC for. The next column gives validation that have been done in the past to support these applications and those various acronyms refer to different test facilities that have been done. Mostly the integral test.

For equipment qualification and hydrogen mixing, there has been quite a bit of work done with GOTHIC, especially looking at some details for ratification and plumes. A lot of this was done more recently in TOSQAN, MISTRA, and also not mentioned there, but ongoing work with the ThAI facility in Germany.

MEMBER BANERJEE: What about PANDA?

MR. GEORGE: PANDA we have not done directly. PSI has used GOTHIC extensively for modeling those experiments and in fact uses it to help design those experiments. But we have not included that in

our validation base.

MEMBER BANERJEE: Could you tell us what level of nodalization PSI had to use?

MR. GEORGE: Well they have used two and three dimensional models for the PANDA facility. I don't remember the height of that facility. It seems it is five meters or so, maybe a bit higher than that. But they will use up to 20,000 to 25,000 cells.

MEMBER BANERJEE: And did they use GOTHIC --

MR. GEORGE: Yes.

MEMBER BANERJEE: -- with 25,000 cells?

MR. GEORGE: Yes.

MEMBER BANERJEE: And did they try to nodalize around the plumes?

MR. GEORGE: Yes.

MEMBER BANERJEE: How successful were they in getting the results?

MR. GEORGE: I think overall they have been happy with the results. They have done comparisons with GOTHIC and with CFD analysis. And overall, they are happy with GOTHIC. GOTHIC has some advantages over some of the CFD because of the way it can handle the condensate and the films and the tracking of the films and so on.

So there is some tradeoffs there but overall they have been very happy with GOTHIC. There are some details that they are looking at, the effects of film penetrations down into the lower containment. These are some fine details that are of interest but probably well beyond what are talking about here.

MEMBER BANERJEE: So do you think that the nodalization that you are referring to here would be able to resolve maybe locally high concentrations of hydrogen, which could be greater than ten percent?

MR. GEORGE: If the sprays are active, I think that the containment is going to be well mixed. If there are no sprays and if --

MEMBER BANERJEE: Well, there are some scenarios without sprays, right? I mean they are referred to in this study here that I have been looking at. Or late initiation of sprays.

MR. GEORGE: Late initiation of sprays?

MEMBER BANERJEE: Uh-huh.

MR. GEORGE: It is a little difficult to say because if you have a hydrogen release, you are likely to have a lot of other heat sources in your containment high temperature heat sources. And those by themselves will generate some mixing.

And so some of these tests where you just have a hydrogen flow by itself are of interest but it may not be really representative of an accident condition, where you have got a lot of other heat sources in the containment at the same time.

So overall, I would expect that there would be a fairly well mix of environment above the level of the heat sources and the hydrogen distribution. That has generally been what has been found is that you do get a plume that comes up. A plume evolves and develops but above the location of the plume, eventually you get a well-mixed environment. It does all mix well. And heat sources will contribute to that mixing as well.

And certainly if you have the sprays ongoing, they are a very effective mixing mechanism.

MEMBER BANERJEE: But there are regions which don't mix. Right? I mean one of the regions where this study finds high concentrations of hydrogen is in the reactor cavity area, where the steam carries the hydrogen in and condenses. And you can get over ten percent. And it is pointed out that there is a detonation risk there because they are no igniters.

MR. GEORGE: That is possible. I had not seen that report and looked at those details.

MEMBER BANERJEE: Well, I am sure that Joy would be happy to --

MEMBER REMPE: Well actually, I guess I am a little puzzled perhaps in that answer. You did GOTHIC -- someone from MHI did GOTHIC analyses to interact with the folks that were looking at severe accident research and ERI and whoever was doing the GOTHIC analyses from MHI were going back and forth. And it sounds like you have two vendors or two consultants that do GOTHIC.

MEMBER BANERJEE: These guys used MELCOR.

MEMBER REMPE: The NRC used MELCOR and then they hired ERI.

MEMBER BANERJEE: Right.

MEMBER REMPE: But ERI and the NRC were interacting with someone from MHI that ran GOTHIC, who apparently is a different person, and they did additional analyses if you read this report. And I don't recall, I know it was only last February but it was a different person who was the GOTHIC expert then, I guess. And they don't interact.

MR. SPRENGEL: We will need to open up the phone line. We have representatives calling from MHI Japan.

MEMBER BANERJEE: Well we have also --

MEMBER BLEY: I'll be glad to do it.

CHAIRMAN STETKAR: Thank you, Dr. Bley. We will get the phone line open.

MEMBER BANERJEE: This isn't a study in as much depth as I would like to see because they do hand calculations, which are okay for the jets and plumes. They can't do CFD because they haven't actually got down to that level.

But these hand calculations follow certain correlations which are used from a book by Liszt, a 1982 book. Liszt is from Caltech and did a lot of work on jets.

However, I am not sure these are for buoyant jets. And there is a suppression of turbulence in density differences which slows down mixing. So we need to really do a due diligence to find out whether the correlations they used were applicable to just density jets. But they get fairly high concentrations in the plumes and the regions.

CHAIRMAN STETKAR: I think, as far as I know, the phone line is open. So if you do indeed want some input from whoever is --

MEMBER BANERJEE: First thing would be to read this report.

CHAIRMAN STETKAR: Let's see if we have any other elaboration from whoever is on the other end of the phone line, first.

MR. SPRENGEL: Goda-san, are you on the line?

MR. GODA: Yes, I am.

MR. SPRENGEL: Okay, please introduce yourself and I think Joy had a specific question that was more directed towards your area in the other uses of the GOTHIC modeling.

MR. GODA: Yes, certainly. This is Hiroshi Goda from MHI Kobe. I am a representative for the accident.

MEMBER REMPE: We have been discussing this ERI report that the NRC prepared to summarize the interactions between MHI and the NRC and ERI. And the RAI of interest, it is a reference 17 in this report Sanjoy is number 480-3711, question number 19. It was dated March 2010. And apparently there was someone running GOTHIC that did some different types of nodalization than what was done on Chapter 6. Is that a good way to characterize this? And we were wondering, it is actually Sanjoy who had questions but it is becoming clear to us they were two different people

running GOTHIC.

Were you the person who ran GOTHIC for the severe accident research?

MR. GODA: I'm very sorry about that. I couldn't listen to you. What kind of a document did you find? Could you state again please what the reference document?

MEMBER REMPE: This is all pertaining to RAI number 480-3711.

MR. GODA: Number 480, okay. Oh, I see.

MEMBER REMPE: Now I don't know if they received your consultant report.

MR. GODA: Okay, RAI 480. Okay.

CHAIRMAN STETKAR: By the way, for the record, the parties of interest are MHI and the Staff. It doesn't make any difference who did what analyses for MHI or the Staff.

MEMBER REMPE: Okay.

CHAIRMAN STETKAR: So I personally don't care whether 15 consultants did 15 separate calculations. It is the Staff and MHI sharing information on the record.

MEMBER REMPE: Right. Well, Sanjoy had questions about GOTHIC. It is clear the person here

today is not the person not the person who did these GOTHIC calculations.

CHAIRMAN STETKAR: Okay.

MEMBER REMPE: So the question is, who did the GOTHIC calculations.

CHAIRMAN STETKAR: I don't care who -- all I am saying is I don't care who did it. We need to understand --

MEMBER REMPE: What was done.

CHAIRMAN STETKAR: -- what was done and the results of what was done.

You know if the gentleman on the other end of the phone didn't personally perform or lead a group who did the GOTHIC calculations, that doesn't matter.

MEMBER REMPE: But can he answer what was done, is what I am trying to say.

CHAIRMAN STETKAR: That is the important part.

MEMBER REMPE: Perhaps I didn't word it correctly. Okay.

CHAIRMAN STETKAR: Thank you.

MR. GODA: We did the GOTHIC calculation in a group. And we performed that on 480. But I'm sorry, I don't have that document here. But the men

went out to perform at station blackout where do not have the power. And then we evaluated what kind of a hydrogen concentration in the RWSP, what these are affected by the ERI.

And then we did evaluations assuming several conditions. I remember that was done for seven cases, I think maybe. Anyway, in that case we performed when the igniters are available and not when the igniters are not available. And we identified when the igniters are not available, then we could see that the high concentration in the RWSP.

And then we provide that answer to the NRC and then they gave us additional RAI number for 627, I believe.

And then we discussed that about how to include the igniter design, especially when do we not have the power.

And then we concluded in RAI 871, which is the latest one for the hydrogen concentration, and we provided the DC Part B for igniters. And then igniters are powered during station blackout. And then we could avoid high concentration in the RWSP as current condition and status.

And also from all these analyses are

performed based on the MAP calculation for the hydrogen leak and then GOTHIC for hydrogen mixing.

MEMBER BANERJEE: So these calculations which were produced in response to RAI 480-3711 were these additional --

MR. GODA: Additional, yes.

MEMBER BANERJEE: Yes, these were the additional calculations, right, that you are talking about?

MR. GODA: Yes, we did.

MEMBER BANERJEE: And you have final nodalization. You divided the node, the dormant to 150 nodes here? Is that fair?

MR. GODA: That was the original node.

MEMBER BANERJEE: That was original. I see.

MR. GODA: Yes.

MEMBER BANERJEE: So could you clarify what the nodalization was in these? Because it was final nodalization compared to the old analysis.

I understand the old analysis used 30 nodes and 150 in the dome. Right?

MR. GODA: That's right.

MEMBER BANERJEE: Okay. Can you tell us

what this did? Because we don't have -- at least I haven't seen this reference where your analyses are detailed.

MR. GODA: Those information not provided in DCD. Instead we issued a technical report number MUAP-07030. The current revision is Revision 3.

MEMBER BANERJEE: Okay, so this was in answer to RAI 480-3711, question 19, I take it.

MR. GODA: Okay.

MEMBER REMPE: Could you repeat the number of that MUAP real slowly?

MR. GODA: MUAP-07030.

CHAIRMAN STETKAR: You said that Revision 3 is the current revision?

MR. GODA: Yes.

CHAIRMAN STETKAR: Thank you.

MEMBER REMPE: Thank you.

MR. GODA: And the document title is "US-APWR Probabilistic Risk Assessment."

MEMBER BANERJEE: Oh, so this is not called the "Additional Sensitivity Analysis for the DDT Potential?"

MR. GODA: No, it is not. It is not.

MEMBER BANERJEE: Okay.

MR. GODA: Additional one is for -- that one is MUAP-10004.

MEMBER BANERJEE: So I am interested in getting this additional sensitivity analysis for the DDT potential and the mixing in the containment.

MR. GODA: Oh, I see. We can give you --

MEMBER BANERJEE: Which I guess that is the one --

MR. GODA: I'm sorry. I'm very sorry.

MEMBER BANERJEE: Was that the one in answer to question 19 in the RAI?

MR. GODA: Yes.

MEMBER BANERJEE: And is that covered in the MUAP that you just gave us the reference for?

MR. GODA: No, it is not. It is another document, MUAP-10004.

MEMBER BANERJEE: Okay, so we should probably get both. We may have them.

CHAIRMAN STETKAR: Well, 7030 is the PRA report. We have that.

MEMBER BANERJEE: We have that.

MEMBER REMPE: And we actually have the 10004 P that was given to us. I have trouble keeping up with revs but it was given to us before. I have Rev

0 and it was given to us before we did Chapter 19.

MEMBER BANERJEE: So we will have the March 2010 answer to the RAI somewhere. Right?

MEMBER REMPE: It was in there. Somebody gave it to me before Chapter 19. I have got it here and I can hand it over to you.

MEMBER BANERJEE: So I haven't actually looked at this additional sensitivity analysis with the final nodalization. Could you just tell us what the nodalization was? Because there is an illusion that you also tried to nodalize finer near the plumes and jets.

MR. GODA: For that one we made some nodalization especially where the hydrogen is released during the accident. Like a LOCA event, we considered how the hydrogen is released in a LOCA break point and the plumes were upwards or downwards, sideways. Those tests we did are in this document.

MEMBER BANERJEE: So do you feel that you could, with the nodalization that you used, I don't know how fine it was, but were you able to capture regions of local high concentration in the plumes before they entrained more air around them?

MR. GODA: Yes, I think so.

MEMBER BANERJEE: Well what about the nodalization?

MR. GODA: In that nodalization anyway we considered -- in our model, we provided the hydrogen igniters where the hydrogen released in the RCS break.

And then we evaluated even for the fine nodalization. And then we performed the effectiveness of hydrogen igniter.

MEMBER BANERJEE: Right. So if you had the igniter, clearly it would burn. But in regions where there were no igniters, for example in the region of the reactor cavity where steam could carry hydrogen and condense, giving you local high concentrations, how did you evaluate that?

MR. GODA: Well, there was --

MR. SPRENGEL: Goda-san, Goda-san, just one second.

We are in open session.

CHAIRMAN STETKAR: I was just going to mention that.

MR. SPRENGEL: Please be careful about discussing proprietary information. And if we need to close it --

CHAIRMAN STETKAR: We can close it.

MR. SPRENGEL: -- just let us know. Goda-san, do we need to close this discussion?

MR. GODA: Well, personally speaking I don't care so much already.

CHAIRMAN STETKAR: Look, if there is any question at all, we can close -- this is a subcommittee meeting. So we have a little bit more latitude here in terms of going into closed session.

Well, I will ask you, Ryan, do you have anything else that we can cover in open session? I realize it is an inconvenience for the folks over in Kobe on the line. But if there is anything else that we should cover in open session -- I don't want to go to open/close/open/close. That is the only thing in terms of running the meeting.

MR. SPRENGEL: I think the other material that we have prepared will likely quickly go into --

CHAIRMAN STETKAR: Closed session?

MR. SPRENGEL: It is tied. It is also on hydrogen generation.

CHAIRMAN STETKAR: Yes, okay. I was just curious whether there was anything, any nuggets from any other --

MR. SPRENGEL: Oh, no.

CHAIRMAN STETKAR: Okay, let's do that, just to avoid any drift into proprietary discussions.

So what we will do is close the meeting.

(Whereupon, the foregoing matter went off the record at 8:55 a.m. for a closed session.)

LUMINANT GENERATION COMPANY

Comanche Peak Nuclear Power Plant, Units 3 and 4

ACRS US-APWR Subcommittee

FSAR Chapter 6 –
Engineered Safety Features

September 17, 2013

Agenda

- Introduction
- SER License Condition
- Site-Specific Aspects

Introduction

- FSAR uses IBR methodology
- No departures from US-APWR DCD
- All COL Items addressed in FSAR
- One SER License Condition
- No contentions pending before ASLB

SER License Condition 6-1

- SER states: No later than 12 months after issuance of the COL, the licensee shall submit to the Director of NRO a schedule that supports planning for, and the conducting of, NRC inspections of the preservice inspection and ISI programs. The schedule shall be updated every 6 months until 12 months before scheduled fuel loading, and every month thereafter until either the PSI or ISI programs have been fully implemented.
- Luminant proposed alternate words in which the LC starts out "The Licensee shall submit to the Director of NRO, a schedule, no later than 12 months after issuance of the COL *or at the start of construction as defined in 10 CFR 50.10(a), whichever is later*…" to better address a COL that does not start construction immediately. This wording to be used for all operating programs except Fitness for Duty.
- Wording to be finalized between NRC Staff and Luminant

Site-Specific Aspects

Sections 6.0, 6.3, and 6.5 are incorporated by reference with no departures or supplements

6.1 Engineered Safety Features Materials

Coatings program will be implemented prior to procurement phase

6.2 Containment Systems

- ❑ Containment cleanliness program to be implemented prior to initial fuel load
  - Meets NEI 04-07 and its NRC safety evaluation
  - Latent debris surveys to be conducted prior to startup and during refueling outages
  - Controls ensure RMI, fiber insulation, aluminum remain consistent with the design-basis

- ❑ Containment ILRT Program
  - Defined by Tech Spec 5.5.16
  - Will be implemented prior to fuel load

6.4 Habitability Systems

- Dose to MCR operators in adjacent as well as from existing operating units is bounded by dose to operators in affected unit

6.4 Habitability Systems (cont'd)

- All postulated releases of toxic chemicals resulted in concentrations below IDLH
  - No procedure required for MCR operators to take protective action in response to chemical releases
  - Instrumentation not required to detect and automatically isolate CRE from chemical releases
  - MCR can be isolated manually

6.6 Inservice Inspection of Class 2 and 3 Components

- PSI Program and ISI Program will be implemented prior to fuel load
- Augmented ISI Program to protect against postulated piping failures will also be implemented prior to fuel load

Acronyms

ASLB	Atomic Safety and Licensing Board
COL	Combined License
CRE	Control room envelope
DCD	Design Control Document
FSAR	Final Safety Analysis Report
HVAC	Heating, ventilation, and air conditioning
IBR	Incorporated by reference
IDLH	Immediately dangerous to life and health
ILRT	Integrated leak rate test
ISI	Inservice inspection
MCR	Main control room
NEI	Nuclear Energy Institute
PSI	Pre-service inspection
RMI	Reflective Metal Insulation
SER	Safety Evaluation Report
US-APWR	United States Advanced Pressurized Water Reactor

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

Presentation to the ACRS Subcommittee

Comanche Peak Nuclear Power Plant, Units 3 and 4
COL Application Review

Safety Evaluation Report

CHAPTER 6: Engineered Safety Features

September 17-18, 2013

Staff's Presentation Order

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

- **Stephen Monarque** - Comanche Peak COLA Lead Project Manager
- **Ruth Reyes-** Project Manager

Technical Review Team

- **Michelle Hart -** Radiation Protection and Accident Consequences Branch
- **David Nold** – Containment and Ventilation Branch
- **Clinton Ashley** - Containment and Ventilation Branch
- **James O'Driscoll -** Containment and Ventilation Branch
- **Shie-Jeng Peng** - Containment and Ventilation Branch
- **Gregory Makar** - Component Integrity Branch
- **Steven Downey -** Component Integrity Branch
- **Jeffrey Schmidt –** Reactor Systems Nuclear Performance and Code Review Branch